THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. XCIV. No. 2242.] LONDON, MAY 1, 1906. [58TH YEAR. PRICE 6d.

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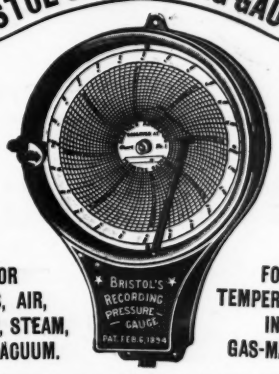

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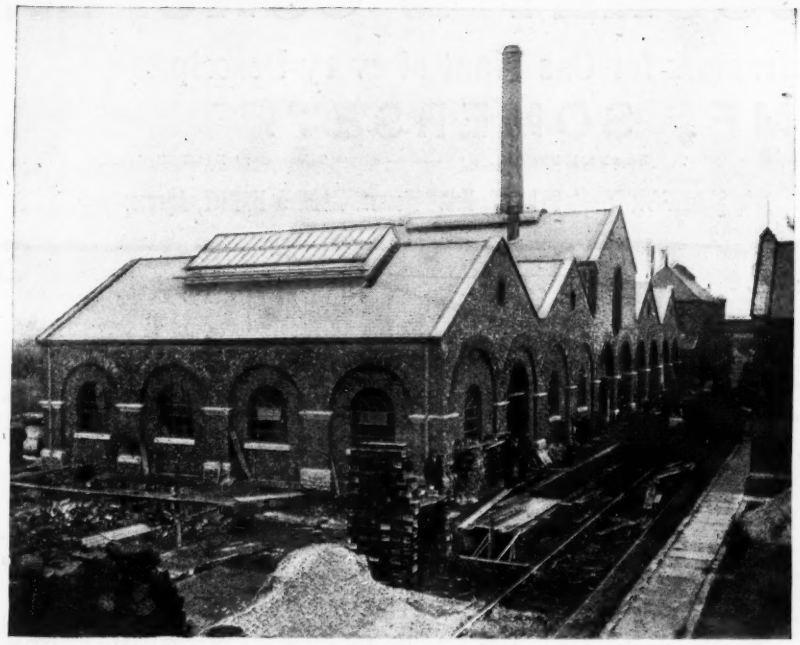

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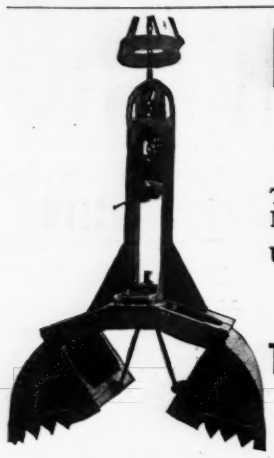

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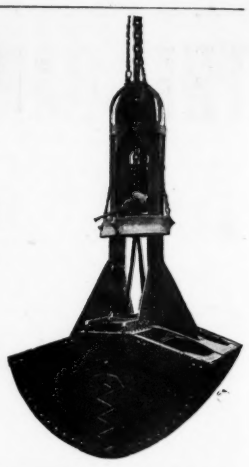

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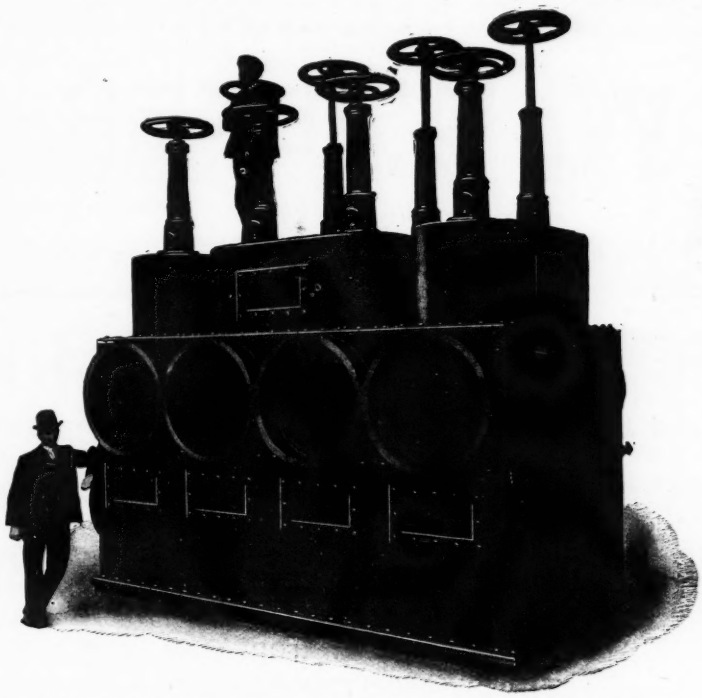

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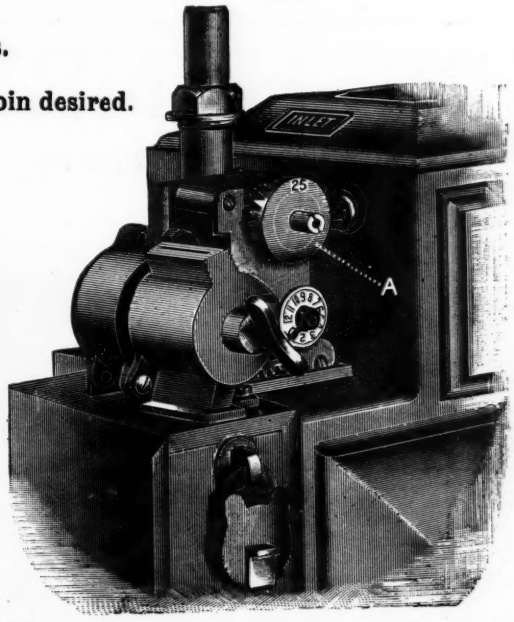

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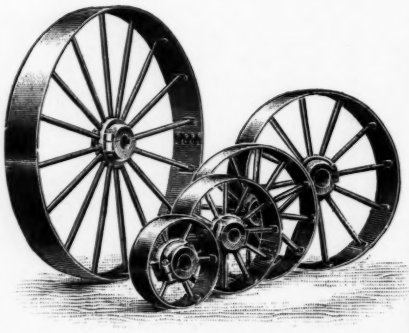

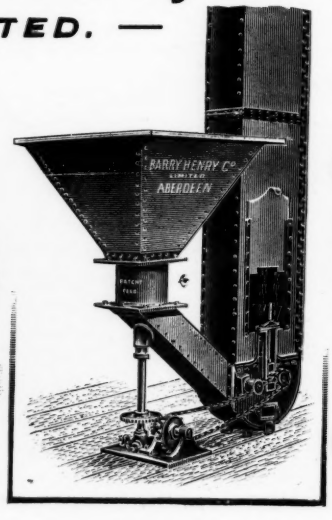

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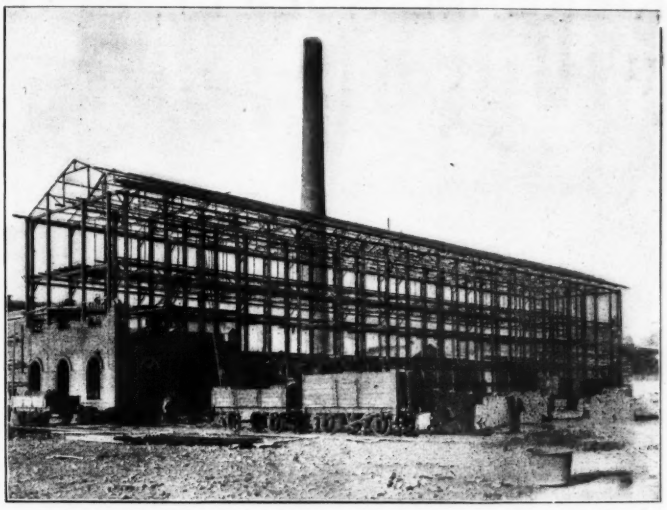

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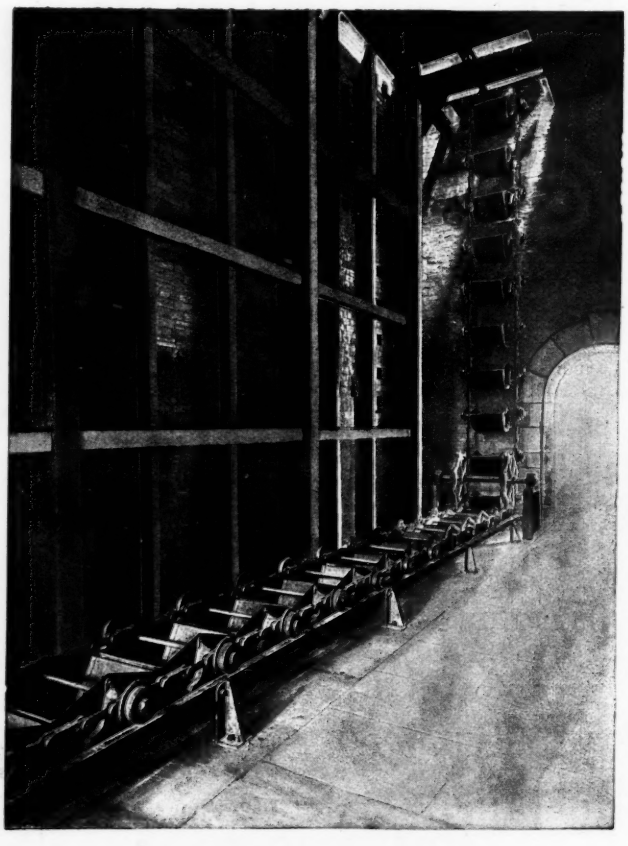

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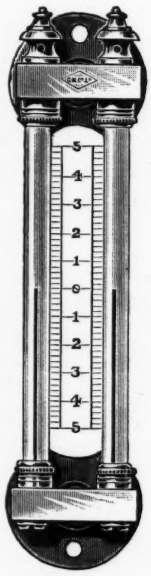

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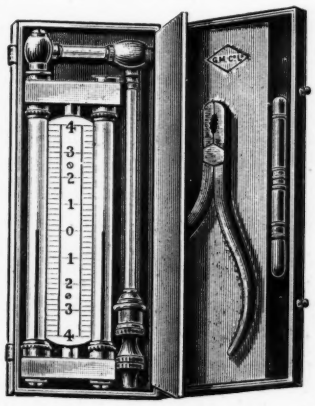

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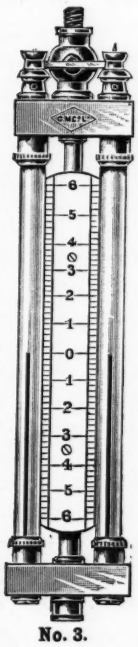

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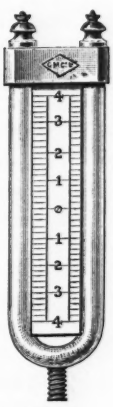

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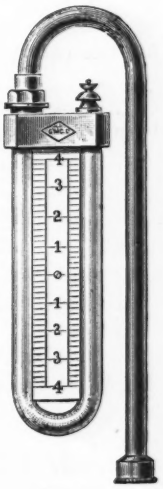

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Dublin	2,000,000	North Middlesex	150,000	Tunbridge Wells	1,000,000
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Dunedin, N.Z.	150,000	Norwich	1,000,000	Utrecht, Holland (Second)	1,000,000
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Vienna	3,500,000	Marlborough	100,000	Bochum, Westphalia	530,000
Maastricht, Holland	200,000	Flensburg, Sleswig	300,000	Brussels–Anderlecht	350,000
Antwerp, Belgium (2nd)	1,000,000	Weston-super-Mare	300,000	Leigh, Lancs.	350,000
Tottenham (5th)	1,000,000	Wexford, Ireland	100,000	Stockport (3rd)	400,000
The Hague, Holland (2nd)	500,000	Budapest, Hungary	50,000	Agram, Croatia.	200,000
Hampton Court.	500,000	Swindon	300,000	Bruges, Belgium	200,000
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Dublin (3rd).	650,000	Oberhausen, Germany	175,000	Lemberg, Galicia	260,000
North Middlesex (3rd)	75,000	Malmo, Sweden	350,000	Leeuwarden, Holland	400,000
St. Gallen, Switz. (2nd)	225,000	Ipswich	750,000	Stockholm	1,500,000
Brussels—St. Josse	1,000,000	Winchester (2nd)	125,000	Romford (2nd)	350,000
Dundee	1,500,000	Zwolle, Holland (2nd)	200,000	Krakau, Galizien	200,000
Bridgwater	200,000	Alkmaar, Holland	400,000	Berlin-Rixdorf (2nd)	700,000
West Ham (2nd)	800,000	Leiden, Holland	500,000	Mayence	700,000

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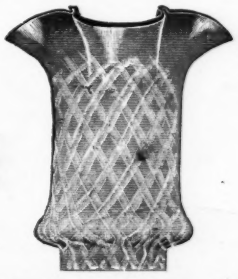

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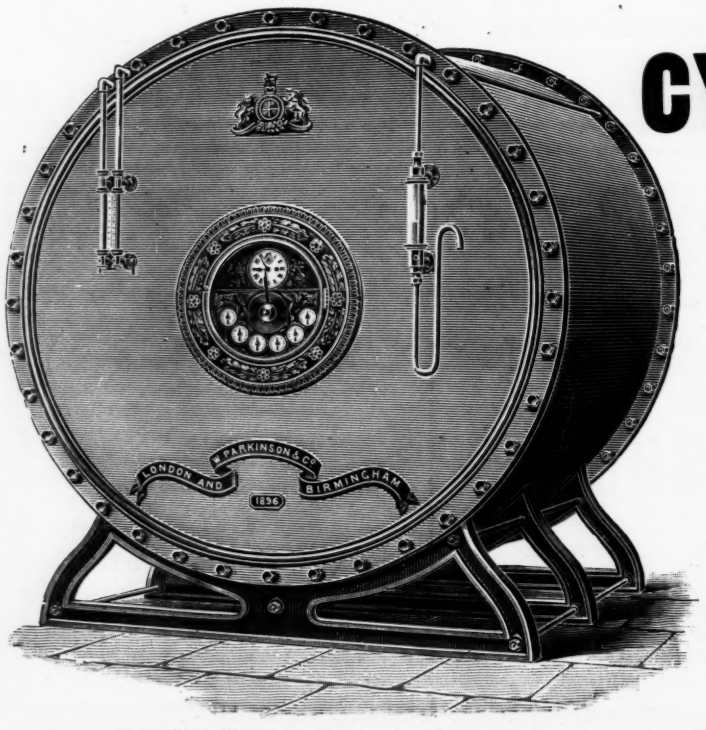

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EDITORIAL NOTES—GAS, &c.

Annual Meeting of the Gas Institution.

MEMBERS of the Institution of Gas Engineers will now be looking forward to the annual meeting in London, which commences on Tuesday, June 19, and will be shaping their plans accordingly. The programme for the occasion has not yet been fully completed. There are a few gaps still to be filled in; but arrangements are sufficiently advanced for the Council to give publicity to something more than an outline. Upon this, it is quite safe to say that the meeting will not be one whit less interesting than those of recent years; and in at least one respect the proceedings will be exceptionally attractive. The technical part of the programme, so far as it has been definitely determined, is altogether up to-date in its subject-matter; and there is nothing but confidence in saying that the President (Mr. Charles Wood, of Bradford) and the Council of the Institution will surely have cause for the fullest satisfaction at the close of the meeting in June, and will be the recipients of the members' heartiest congratulations. The Inaugural Address of the President is bound to reach the highest expectations; and the names of the authors of the papers so far accepted are sufficient to assure of first-class production and adequate treatment. Although a lecture, when delivered by a man of distinction in one of the many directions of research and work which the gas industry offers, is always a good lodestone, we are not sorry to see it dropped by the Council if the promise of good and important papers is sufficient to fill the available time. And there is every indication that on this occasion it is. It has certainly been rather distressing, at one or two meetings of recent years, to witness the slaughter of discussion on papers owing to the want of time; and if the whole of the authors—their papers having been accepted by the Council—get fair treatment (it is not alleged there has been intentional bad treatment hitherto), no one will regret the absence of the lecture. But it is to be hoped that this will not be taken as an irrevocable precedent; for there may be times when it would be preferable to sacrifice indifferent papers to give place to a special dissertation such as the members have become accustomed to on the second morning of the meeting.

Foremost position must be given to the papers which will treat of the subject of vertical retorts. "Retorting" is the title given to a paper by Mr. Thomas Glover. The appellative word may apply to any one system of carbonization or to all; and there is reason for surmise that, if Mr. Glover commences with the carbonization of coal in horizontal retorts, he will end by discussing the potentialities of the vertical retort. As a preliminary to the discussion of the paper, the reading of the brilliant series of articles by Mr. William Young which have recently appeared in the "JOURNAL," on vertical retorts, will be of the greatest service. Welcome, indeed, in our midst will be Herr E. Körting, the Chief Engineer at Berlin of the Imperial Continental Gas Association. The bearer of the highly respected name of Körting, and such an enthusiastic investigator of, and worker on, vertical retorts as he is, will be assured an interested hearing at the meeting. He is going to deal with "The Vertical Retort from the Practical Point of View."

Retort-house operation will not be exhausted by these papers, as Mr. Edward Allen, of Liverpool, will give further information as to "The Fiddes-Aldridge Stoking "Machinery at the Wavertree Works" of his Company. A general account of this installation has already been published in our columns; and it may be helpful in suggesting matters for inquiry. "Notes on the Argand Burner" will be contributed by Mr. Charles Carpenter; and interest is lent to this announcement by the acceptance by the Gas Referees of the Carpenter "Metropolitan" burner No. 2 as the standard test-burner for London. Other topics for consideration will be "The Associated Management of Gas "Undertakings" and "The Relations existing between "Gas Undertakings and Road Authorities with regard to "the Laying of Mains and Service-Pipes." Both subjects are in capable hands. Mr. R. Bruce Anderson will deal with the former; and he has the experience derived both by himself and his distinguished father and predecessor in professional work. Mr. Francis T. Cotton, too, has had, as our "Legal Intelligence" has from time to time intimated, such experience of the relations that exist between gas undertakings and road authorities with respect to the laying of mains, that he will be in a position to impart interest and value to his subject. There are still other papers under consideration; but here there is almost enough, with the presidential address and the ordinary business, to absorb the time usually set apart for the technical meetings. During the week, some of the London Gas-Works will be open to the inspection of the members. There will also be a reception by the President and Mrs. Wood; and the excursion on the Friday will be to Folkestone, whence those who care for a sea trip will be able within the day to visit Boulogne. The programme is a good one.

Effect of the Sliding-Scale.

BY way of supplement to the report of the Massachusetts Committee, to which reference was made in these columns last week, the report by Messrs. Stevenson and Burstal, upon the "Sliding-Scale in Modern Legislation," which we are enabled to publish this week, is of considerable value. It is addressed to the President of the Boston Gas Company, having been prepared at his request and for the Company's guidance; and it will be generally recognized as an illuminating and informing document. In the terms of reference, Messrs. Stevenson and Burstal—who, so far as is known, are not directly connected with the management of any sliding-scale Gas Company—were required to report upon the comparative benefit or otherwise conferred upon the consumers of gas by the adoption of the standard price and sliding-scale in modern legislation in Great Britain. They were enjoined to approach the consideration of the subject "with an open "mind;" so as to ascertain, or to lay facts before the Company from which they could judge whether "the sliding-"scale worked to the advantage of the consumer." The result has been the production of a report creditable alike to the ability and the impartiality of its authors. Anything in the shape of "pious opinions" on the subject is carefully suppressed; and nothing is taken for granted—the report being founded solely upon the "Parliamentary Returns" and "Field's Analysis."

With regard to this the authors say: "We abstracted the "figures from the returns to Parliament without the slightest "knowledge of what they would prove; though we—like "many others—held the opinion that the sliding-scale was "of benefit to the consumer, but without having the data to "prove it." What do the figures thus abstracted prove? They show, in the first place, that there is a considerable difference between the capital expenditure of sliding-scale companies and that of maximum-dividend companies. The average of the former—excluding the three London Companies—is £481 per million cubic feet sold, as compared with £598 (or £626 if certain companies be eliminated for the reasons stated in the report) in the case of the latter. On this highly important aspect of the subject, the report states that there can "be very little doubt that, taking the "two groups of companies, each as a whole, it will be ad-"mitted that the inducement to earn higher dividends has "had the effect of putting an end to all capital expenditure "except such as is absolutely necessary. While it is com-"paratively easy to earn maximum dividends, there is no "inducement to look carefully after capital expenditure.

"But when, by a reduction in the price of gas, increased "profits can be divided among the shareholders, all capital "expenditure is carefully criticized and reduced to the lowest "possible amount." This observation, founded as it is on the above figures, cannot but be affirmed by all who have had experience of the working of sliding-scale companies. It might have been commended to the consideration of the majority of the Massachusetts Board of Gas Commissioners; but they are already hopelessly committed to what may be termed dependence on the course of events, or, would it be right to say, reliance on their own ability to control the capital expenditure of the undertakings under their charge? With regard to this, reference need only be made to the present position of gas affairs in Boston.

In the next place, it is seen that during the twenty-three years from 1880 to 1903, the average reduction in price per company of sliding-scale companies has been 11·18d. per 1000 cubic feet, compared with 7·77d. in the case of maximum-dividend companies; the difference in favour of the former being 3·38d. As remarked in the report, this does not appear to be a very large difference. But it means to the consumers of the sliding-scale companies a saving of no less than £127,764 per annum; while a similar reduction to the consumers of the maximum-price companies included in the comparison would mean a saving to them of £320,368 per annum.

The report deals separately with the three London Companies—the figures with reference to which are taken from "Field's Analysis," as it brings them down to a year later than do the Parliamentary Returns. These are quite as favourable to the influence of the sliding-scale as are those relating to the Provincial Companies, and this part of the report will be read with special interest. It did not, perhaps, fall within the scope of the report to refer to the parliamentary inquiry of 1899, which resulted in a confirmation of the principle of the sliding-scale; and it is to be noticed also that in Messrs. Stevenson and Burstal's observations on the Gaslight and Coke Company they practically endorse the observations of others as to the satisfactory condition of the Company down to about the year 1890. It is really the period since then which, by comparison, has proved unsatisfactory. The report does justice to the Company in regard to the reasons for this; the principal one being the severe competition with the electric light in their most important districts. But in this connection may be mentioned, as a weak spot in the otherwise impregnable armour of the sliding-scale, the temptation, in times of stress, to maintain high dividends longer than it may be prudent to do so.

The large reduction of capital expenditure in proportion to the sales—particularly in that of the South Metropolitan and Commercial Gas Companies—is duly set forth. With regard to the latter Company, it is noted that until the year 1902 they were not under any obligation to raise capital by auction. This fact may be commended to the Massachusetts Board of Gas Commissioners, the majority of whom lay stress in their report upon the influence of the auction clauses. From 1883 to 1904, the capital expenditure of this Company on increase of business was £423 per million cubic feet, as compared with £394 in the case of the South Metropolitan Company, and £505 in that of the Gaslight and Coke Company. It will be seen from this how powerful has been the influence of the sliding-scale in counteracting the temptation to issue additional stock to the shareholders even at a high rate of interest. On all grounds covered by the report, the conclusion to it is fully justified—viz., "that "the giving of an inducement to the companies to provide "gas at the cheapest possible rate has had a beneficial effect "upon the consumers."

Eastern Counties Association Meeting—
Projector Working and Inclined Retorts.

It was a foregone conclusion that the meeting of the members of the Eastern Counties Gas Managers' Association at Grantham last Wednesday would be full of attractive feature. The individuality of the President (Mr. R. G. Shadbolt), the address which he delivered last autumn at Cleethorpes which in the main was unique in its subject-matter, the opportunity of investigating the gas-blending process then described within the walls of the retort-house itself where the investigation has been proceeding, and last, but by no means least, the paper that Mr. J. W. Auchterlonie was bringing before the members—recounting his experiences in the working side by side of an inclined retort-house and a horizontal one operated by De Brouwer machinery—formed, taken together, such a solid base for a successful meeting that there was not room for doubt that the anticipation before the day would at its close be found to have been fully realized. And so it proved. Moreover, Grantham holds for the members of the Association something akin to that affection which one ever entertains for his birthplace; for seventeen years ago in that town, and under the presidency of Mr. W. Barratt, the first general meeting of the Association was held. The ravages of time have left few of those who were of the founding membership; but in the seventeen or so years, from the, comparatively speaking, handful of members, the roll has grown until now it has reached all but its century. The vitality of the organization has increased with time; and its records are the certificates of usefulness accomplished. Never before the Association came into existence did those managing the gas undertakings of the Eastern Counties know so much as they do now of each other or of each other's work. Their sympathies have broadened; and ever-expanding intercommunication has made for strength. If the Association had done nothing but this, its existence would have been amply justified.

There was another feature of the meeting on Wednesday that must be referred to, though for the moment it delays reference to the technical part of the proceedings. It is that, though the gas supply of Grantham is a Company possession, the head of the Corporation in the person of His Worship the Mayor, and the head of the Municipality's official staff in the person of the Town Clerk, joined with the Chairman and Directors of the Company and the President in extending personal courtesy to the Association, and had a large share in providing facilities for the day's work and pleasure. In every way, the amicable relations of the two bodies was evident, and Grantham may in this respect be held up as a model to many other local companies and public bodies. It was not always thus in Grantham. The secret is the cultivation of the *entente cordiale* between the corporate body and the Company's administrators and between their respective officials. That useful aid to the maintenence and furtherance of international comity is not the peculiar privilege of those in high places; but it can be brought to bear with happy effect upon the ordinary interests of one's daily life. A gas company has a great interest in fostering that which tends to the commonweal; and the commonweal should be the objective of all the activities of a local governing body. Interests are therefore identical; and friendliness between such bodies will achieve more that is mutually advantageous than the watchfulness that obtains in some places for even paltry, and not always particularly reputable, opportunities for friction.

Turning from the thoughts arising from general impressions at Wednesday's meeting to the only technical subject that was under formal discussion. Inclined retorts have had a fairly good repose from the restless controversy of which they were at one time the centre. The difficulty has been to arrive at a fairly comparable basis of comparison between them and other carbonization processes, in which the most approved charging and discharging machinery is employed. It has been made evident that no true comparison can be effected unless all fundamental and contributory circumstances of the two systems are conformable; and such conformity can really only obtain in one works. And there are indeed very few works in which there is all-round harmony between two retort-houses such as can be accepted as a conclusive basis for comparison. Useful as is Mr. Auchterlonie's paper, that usefulness is partially destroyed by the variations in the conditions of the two houses; and taking his figures alone, it is difficult to extract guidance from them in all respects. The greatest merit of the paper lies in the fact that it is the first, if memory does not deceive, that has put into comparison a retort-house worked on the De Brouwer system of charge projection and ram expulsion with one on the inclined system. At the very outset, however, we are confronted by some variations in condition, the pointing out of which must not be taken as an indication of partisanship, but of a desire to emphasize that the paper should not (pleased as we are with the new forms of charging and discharging machinery now on the market) be taken as the last word that can be said as to the relative advantages of the systems under notice. Here we have in the one case new horizontal retort-settings, with eight retorts in each,

pitted as it were against comparatively old inclined retort-settings, with only six retorts in a bed. Without any reference to figures, this single fact, taking either of the common units upon which costs are based, would convince the gas practitioner, though all other conditions might be uniform, that the labour and the fuel accounts would be proportionately higher, and the quantity of coal dealt with proportionately lower per man, in the inclined retort-house than in the horizontal one worked as here. Limitation affects the result. With new types of stoking machinery on the one hand, and with the inclined retorts on the other, we appear to have arrived at the irreducible number of men required in the present processes of carbonization; and it is only when houses on both systems are large enough that the actual limit of the capacity of the men and of the systems for lessening costs can possibly be arrived at. This is seen by placing Mr. Auchterlonie's results from his inclined retort working into comparison with those already published from larger installations, and also by the statements made by Mr. Robert Porter and Mr. John Young in the course of the discussion. Therefore had the Cambridge inclined retort-house eight retorts in a bed, and were the retorts as new as those in the horizontal house, the difference of 1·816d. in labour might be largely diminished. Then again, while Mr. Auchterlonie's figures are not altogether comparable in themselves through these variations in the conditions of the benches and working, other circumstances at Cambridge will not allow of their comparison with benches in other places worked under dissimilar conditions, such as those pointed out by Mr. Jolliffe. So that it is impossible to truly differentiate merits from what is before us, though, as Mr. Jenkins pointed out, the superior economy which the Cambridge figures *primâ facie* show for the horizontal settings, are corroborated by figures obtained under more consistent conditions, in the case of larger installations of similar retorts—both inclined and horizontal operated by the same type of machinery—within one works. We should be glad if Mr. Jenkins could prevail on the engineer of the works in question to expand the interesting information given on this point.

While these arguments are advanced in defence of the inclined setting against summary condemnation as an economical system in comparison with modern horizontal working, it must not be overlooked, too, that Cambridge does not give full play to the economical possibilities of horizontal retorts with the projector and ram-discharging system of working. If the Cambridge house would permit, these two machines could accomplish five times the work they are now called upon to perform. That is one, and an important, consideration, and another is that Mr. Auchterlonie shows that this system saves having retort-houses of the greater heights demanded by inclined settings. There is also the liberty that the horizontal retort compared with the inclined retort system gives in the choice of coal; for there appears to be more general agreement in these latter days (though strong dissentients are still to be found) that all coals are not suitable for carbonization in inclined retorts, while the gas coal has yet to be found that cannot be dealt with by a projector.

Two or three more interesting features must not pass unnoticed. The figures given by Mr. Auchterlonie in his reply to the discussion are eloquent of the great gains that have been effected in the endeavour to achieve more economical carbonization. Between the days of hand stoking at Cambridge and the present systems of operation, a saving of no less than 3s. per ton of coal has been secured in carbonization costs; and that is within a little the difference the application of inclined retorts made at an early date, when they partially superseded hand working. It is due largely to the inclined retorts that the horizontal retort-house with all its new equipment has been a light charge upon the capital account of the Company. When we consider this illustration of modern and former costs, it impresses the rapidity with which economy in carbonizing has been effected. The success urges to further activity; and looking round, it may well be asked, Are we within measurable distance of further advances in economy? There is promise; and more than that cannot be said. What appear to be feasible projections for facilitating carbonizing work and improving results are before us. Looking at such papers as that presented by Mr. Auchterlonie, and then out upon the work that is being vigorously prosecuted here and there, it fills the mind with the brightest of reflections, and the future with more than ordinary interest.

North of England Association Meeting.

WITHOUT professing that the classification is complete—as in the minds of the more philosophical there may be other divisions, and particularly subdivisions, of the subject—it may be said that the communication of knowledge is divided into two parts. The one is that which contains principles of a general nature, which are universal and unalterable; the other is that particular or detailed information, sometimes termed specialization, which is applicable to local conditions and affected by circumstances. The first may be compared to the exercises of Euclid, and the second to the ordinary calculations of a counting-house. Both the papers which were communicated to the North of England Gas Managers' Association at their half-yearly meeting in Newcastle on Saturday, partook largely of the character of the former. What was contained in them was of universal and not of local application; and any variation that may be attempted upon the principles laid down, will not affect those principles, but will be attributable to environment or personal taste—in fact, to the obtrusion of that human element which has always been, and still is, the greatest weakness in the processes of applying the laws of Nature.

Mr. R. Nelson, of Hull, in his paper on gasholder design, reached, by an exhaustive series of comparisons, some general conclusions as to the designs which are admissible and those which are inadmissible in gasholder construction. A study of his comparisons will make it easy, as Mr. Bower remarked, for the designers of gasholders to avoid pitfalls, into which many have stumbled through lack of the display of such points as Mr. Nelson has been able to emphasize. Upon that part of his paper there was no discussion. It was only his views upon the methods of preserving structural steel-work which were open to criticism, and which were, as matter of fact, criticized. This illustrates the sound nature of the views he put forward. The paper read by Mr. James Foreman upon photometry was, to use a common expression, of an even more scientific nature. It dealt truly with the application of first principles to the problems of artificial lighting—again proceeding by an exhaustive process of comparison. Mr. Foreman dealt with a more pliable, but also a more elusive subject, than did Mr. Nelson, inasmuch as he had only to inquire into the one problem of the diffusion of light, in which there are not so many forces to contend with as there are in the work of rendering a gasholder stable. Adopting "mean hemispherical candle power" as a standard, Mr. Foreman was able to bring into focus the relative merits of the leading lamps in the market; and the conclusions he arrived at were of such a bird's-eye nature that they are plain to all at a glance, and must be convincing to everyone who takes the trouble to look at them. To gas engineers it will be particularly gratifying to find, from this exhaustive inquiry, how well their industry comes out, both in the matter of duty and in the matter of cost. The value of the communication is greatly enhanced by the contribution made to the discussion by Mr. R. Watson, of Doncaster.

Two papers of such highly educative quality submitted at one meeting will do much to make the year in which Mr. Leaf was President a memorable one for the Association. Mr. Leaf now retires from office in the North of England Association with well-earned honour, the sense of which, on the part of the members, is evidenced by their spontaneously appointing him their representative upon the Council of the Institution of Gas Engineers, to which body his ripe experience and winning personality should be an acquisition. The North of England Association, in electing Mr. Thomas Hardie, of Gateshead, as their President, have returned to a practice which they have adopted with success on several previous occasions—of placing their chief office in the hands of one of their younger members; and there is every reason to anticipate that, on this occasion, they have again made a happy choice.

The Government Trade Disputes Bill.

THE House of Commons has lost little time in affirming the principle of this measure; for it was read a second time last Tuesday without a division, although the Leader of the Opposition declared it to be "scarcely second in importance "to any the Government have adumbrated or are likely to "bring forward in the course of their tenure of office." It might almost be inferred from this that all parties are in practical agreement as to the Bill; and certainly the Trade Unions have already very good reason to anticipate both

an easy and a complete victory. The speech of Mr. Balfour was, in fact, directed, not so much against the Bill itself, as to what was likely to happen to it when in Committee, in consequence of the overwhelming vote in favour of the Bill brought in by Mr. Hudson on behalf of the Trade Unions. That Bill, it will be remembered, seeks to secure the absolute immunity of Trade Union funds from all liability for the acts of members of such Unions; and the ex-Prime Minister declaimed with eloquence against the danger of such class legislation, by which certain associations might be empowered to do wrong without the possibility of any remedy being exacted from them. Give equality to Trade Unions by all means, but do not privilege them.

There is, as may be supposed, some misconception as to the law on the subject, and the position occupied by Trade Unions, as the result of previous legislation. As regards the former, the Solicitor-General, when moving the second reading of the Bill, combated, not unsuccessfully, the idea that the intention of it was to free Trade Unions "from the "liability which attaches to all other corporate organiza- "tions." Trade Unions are not, in fact, at the present time corporate bodies in the sense that public companies or corporations are; and to make them so would result in considerable inconvenience. For example, in the event of their being corporate bodies they could, of course, sue an employer who sought to bring about any breach of contract between a Union and its members; and it would be illegal for him to offer his men money to return to work on the occasion of a strike, as has been done in some cases. A Trade Union, moreover, would then be entitled to go before a Court and demand to receive the aid of the law, as represented by the police, and possibly even the military. Peaceful persuasion would then take the form of batons and perhaps bayonets. It is as well to look on this side of the subject, and to realize, if possible, the aspect of the case as put by Lord Morley in the discussion on the Trade Unions Act of 1871, and as quoted by the Solicitor-General. Lord Morley stated that "the objects of Trade Unions were mostly such as Courts "of Law should neither enforce, modify, nor annul, but "such as should rest on consent." That being so, what was the intention of the Act of 1871, the interpretation of which by the Judges has given rise to the agitation for an alteration of the law. By the Act of 1871, a previous Act—that of 1859, which permitted peaceful picketing and peaceful persuasion—was repealed, under the idea that this was being re-enacted under another form. The advocates of the Bill claimed, therefore, that their object is to restore the condition of things as it existed prior to 1871. This, however, by no means answers the objection of those who know from experience what peaceful persuasion and peaceful picketing really mean. Not to mince matters, they mean intimidation and coercion—weapons with which the striker seeks to arm himself for the conflict.

But is there not a better way, in the interests of the employed as well as of the employer? Why should not the law continue to discountenance, as at present, all attempts at coercion and intimidation, and set up as an alternative Courts of Arbitration for the settlement of trade disputes, in the composition of which workmen would be adequately represented? So reasonable a solution is, however, hardly likely to be arrived at so long as both the principal political parties find themselves unable to act independently of the Labour and Nationalist parties in the matter. As was pointed out by Mr. Rufus Isaacs in the course of the debate, Bills equally favourable to the Trade Union contention passed the second reading in the last Parliament by majorities of 39 and 122, from which it is evident that many Unionists voted in their favour. While, therefore, it is permitted to hope that that which is to be feared may still be averted, it is but too apparent that the chances of the latter have sensibly diminished.

London Junior Gas Association.

Last Friday was "Question-Box" evening with the London and Southern District Junior Gas Association; and a tolerably comprehensive list of queries was submitted for discussion—indeed, there was a far greater number than it was possible to consider in the time at disposal. Naturally, the inquiries generally had reference to the industry with which the members are connected; but one of them, so far as the Association itself is concerned, came even nearer home than this. Fifth on the list was the pertinent question, "What is the cause of the low average attendance at our meetings?" The preceding subjects having been satisfactorily disposed of, the handful of stalwarts who had turned up on Friday settled down to discuss this topic; and various remedies were suggested for the unfortunate state of affairs which it was impossible to deny exists. On several occasions, during the present session particularly, the attendance at the meetings has been lamentably small; and even on Friday, when the programme was one in which everybody who chose could have taken an active part, certainly not more than a dozen members were present. This faithful few devoted themselves seriously to the problem which faced them; but it would have been even more interesting, had it been possible, to hear the explanations of the others as to why they did not put in an appearance. It is true that several of the more prominent members (including the President, Mr. Walter Grafton) advised the Secretary of their unavoidable absence; but what of the many who made no sign? Is it really a fact, as one of the members remarked, that the proceedings of the Association are not sufficiently attractive? If so, the members are not going the right way to make them more so. An annual dinner and a summer outing might conceivably do something, and an occasional lecture by an engineer or chemist would doubtless do a great deal more, to induce new members to join; but would it cause those who are already members to be more regular in their attendance at the meetings? This is matter for speculation. There is, however, one thing about which no doubt at all can exist, and that is that the rendering of the meetings attractive must rest mainly with members themselves. The Association already, we believe, numbers about sixty; so that there is no reason why all the work should devolve on a handful of men. Out of this number, an average attendance of (say) thirty might not be impossible to secure; and that of itself would render the meetings a great deal more attractive than they are apt to be at present. It would lead to some livelier discussions, and would also unquestionably make it easier for the Secretary to obtain promises of papers. Here is the best remedy; will not the members generally try it? We are sorry to see the London—alone among the Junior Associations—threatened with a sort of creeping paralysis, and hope that the members all will make a firm resolution to see that next session their own Association is not in any respect behind those existing in other parts of the kingdom.

Depreciation on Gas Plant and Machinery.

The Secretary of the Colonial Gas Association, Limited (Mr. A. J. Kingdon), informs us that they have now come to an arrangement with the Income-Tax Commissioners, with regard to a yearly deduction for depreciation on plant and machinery, but not on mains and buildings. It will be interesting to gas engineers to know that the claim of the Association was based upon the particulars contained in the paper read by Mr. A. Yuill, of Dundee, before the North British Association of Gas Managers, and printed in the "JOURNAL" for July 25 last, p. 245.

Miners and Accident Compensation.

A deputation from the Mining Association of Great Britain had a long interview last Thursday with the Home Secretary, before whom they placed their views on the Workmen's Compensation Bill. Speaking for the South Wales Coalowners, Mr. Henry Lewis said that in this district the liabilities for accidents under the existing Act are dealt with in three ways; and a very serious state of affairs prevails. The methods are a contracting-out scheme; by insuring all risks with large companies; and by mutual insurance against extraordinary risks, each coalowner dealing with his own ordinary accidents. Under the contracting-out scheme compensation is paid from the date of injury, and thus the time limit does not apply. But last year compensation was paid under this scheme to no less than 343 men per 1000 employed. Apart from this, there is a prevailing practice among the men of supplementing their compensation by insurance in clubs, &c.; and at one colliery where there was a club for assuring each man 12s. per week for the first fortnight after receiving an injury, the owners last year compensated under the Act at the rate of 155 men per 1000 employed. The employers argue that if such a state of affairs exists with a payment of 12s. a week—the amount in both the instances quoted—it would be infinitely worse were

the compensation under the Act (averaging with them about 15s. a week) payable from the date of injury. Mr. Nelson, the Actuary, reporting to the Employers' Mutual Indemnity Society, also points out that "the number of accident claims is directly influenced by the amount of the allowances, and that the only practicable way of retaining these claims at a reasonable percentage is by strictly limiting the amount of the pay." If they effect complete insurance, the employers do not avoid the additional burden, for premiums are steadily advancing—having already increased from 50 to 100 per cent. These are the considerations which led the deputation to suggest that the great advantages of compensation for accident could be maintained, and malingering reduced to a minimum if over-insurance by the workmen were rendered impossible, and the men were also prevented from insuring themselves for the first fortnight of injury. They further urged that after compensation had been paid for twelve months the scale of payment should be reduced, in accordance with the almost invariable rule of Friendly Societies.

Advantages of Coalition.

In this country the times when it was usual to have the mains of two or more competing gas undertakings in the same street, have long gone by; but elsewhere there are still places to be found where something like that state of affairs exists. In Buenos Ayres, for instance, as Mr. H. E. Jones told the shareholders of the Primitiva Gas and Electric Light Company at their meeting last week, there are many cases in which the mains of the three Companies who supply the city with gas run parallel to each other, and the consumption is divided. This, of course, results in a small output per mile of main, with the necessary concomitant of a rather heavy percentage of loss by leakage. Such a method of working cannot well be economical; and there are also many other directions in which coalition between the different Companies would doubtless prove mutually beneficial. Mr. Jones's remarks as Chairman of the Primitiva Company show how fully alive he is to the advantages that would accrue if the undertakings were more united in their operations; and it is to be hoped that sight will not be lost of his assurance that steps in this direction will never fail in finding support from his Board. Meanwhile, it is gratifying to note that the Primitiva Company are enjoying their share of the increased prosperity of the Argentine. The dividend on the ordinary shares has now reached the respectable figure of 7 per cent., though the average return on the whole of the capital invested (including the preference shares and debentures) is still very moderate. The Board are now going to turn their attention to endeavouring to reduce the price of gas, so as to make it more available for trade and power uses; the present charge of about 8s. naturally preventing such expansion in this direction as might otherwise be experienced.

Death of Sir David Dale.—The Weardale and Consett Water Company have lost their Chairman, Sir David Dale. When returning from Cannes, he was taken ill in the train, and had to be removed to the North-Eastern Hotel at York, where he succumbed to heart failure early on Saturday morning.

Waste of Light from Arc Lamps.—In the course of a paper on long-flame arc lamps, recently read by Mr. L. Andrews before the Institution of Electrical Engineers, he stated that at least 40 per cent. of the light emitted by an arc lamp is intercepted by the opalescent globe. This waste, with ordinary arc lamps, appears to be necessary in the first place in order to prevent the dazzling effect which would result from an unscreened arc fixed at a position that comes within the natural angle of sight; and in the second place to give a diffused light, or the effect of a light emitted from a large surface. Dealing first with the screening effect necessary to prevent dazzling, he said this need not be considered if the source of light could be placed at such a height above the ground that it did not come within the natural angle of sight. Here we might take a lesson from Nature. At midday, in mid-summer, when the sun is directly above our heads, and consequently not within the natural angle of sight, the light emitted by it is comparatively unscreened, and is blinding to look at, even for a moment. When the sun is setting, however, and is consequently directly within the angle of sight, so large a percentage of its light is intercepted or screened by the atmosphere that we are able to distinguish objects clearly which are in a direct line between ourselves and the sun. With an ordinary arc lamp, the bulk of the light is emitted at angles of less than 60° below the horizontal, and therefore it is necessary to place such lamps comparatively near the ground to get efficient results from them.

INSTITUTION OF GAS ENGINEERS.

As already announced, the forthcoming Annual General Meeting will be held at the Institution of Mechanical Engineers, Storey's Gate, Westminster; the proceedings opening on Tuesday, the 19th of June, under the presidency of Mr. Charles Wood, of Bradford. The following papers have been definitely accepted, and others are under consideration: "The Fiddes-Aldridge Stoking Machinery at the Wavertree Works, Liverpool," by Mr. Edward Allen, of Liverpool; "The Associated Management of Gas Undertakings," by Mr. R. Bruce Anderson, of Westminster; "Notes on the Argand Burner," by Mr. Charles Carpenter, of London; "The Relations Existing between Gas Undertakings and Road Authorities with Regard to the Laying of Mains and Service-Pipes," by Mr. Francis Cotton, of Dublin; "Retorting," by Mr. Thomas Glover, of Norwich; "The Vertical Retort, from a Practical Point of View," by Mr. Ernest Körting, of Berlin. In order to allow adequate time for the reading of all the papers to be submitted and for discussing them, the Council have decided not to arrange for the delivery of a lecture. The annual meeting of the Benevolent Fund will be held, as usual, at the commencement of the second day's proceedings—*i.e.*, on the Wednesday. In the evening, the President and Mrs. Charles Wood will give a reception. Steps are being taken with a view to obtaining facilities for enabling members to visit some of the gas-works in London during the week of the meeting. The excursion on the Friday will be to Folkestone, when opportunity will be afforded for those who would like to take the trip to Boulogne; the steamer leaving Folkestone at 11.55 a.m., returning from Boulogne at 7.10 p.m.

THE SULPHUR RESTRICTIONS BILL.

The attempted organized opposition to the legislation promoted this year for the removal of the sulphur restrictions has been a painful failure for those who set it on foot. All opposition to the separate measures including clauses to give the promoters relief was withdrawn before the Bills came up for consideration by Mr. Cawley's Committee; and when the jointly-promoted Bill was called last Thursday, although fourteen Companies supplying in many more than that number of towns were still parties to it, only the Newcastle-on-Tyne Corporation appeared, represented by Counsel, in opposition. The Gateshead Corporation and three District Councils had petitioned, but their interest did not go to the length of briefing Counsel. It was a forlorn position for the Newcastle Corporation; and among the several gas engineers present who had come up to Westminster in the expectation of a stiff fight, it soon became known that hope was not a strong point of the opposition.

The Chairman of the Committee lost no time in making it clear that he could not advise his colleagues to go behind the recommendation of such eminent scientists as composed Lord Rayleigh's Committee in the determination of what was a purely scientific question. The opposition, however, persisted; they contending that, being of the Provinces, and the Provinces not having been heard before Lord Rayleigh's Committee, they ought not to be bound by their decision. In such a matter as gas supply, the argument savours somewhat of puerility; for what is good enough in this respect for the Metropolis must surely be good enough for the Provinces. Lord Rayleigh's Committee were fully acquainted with the position of the Provinces in this matter; and there need be little doubt that the fact that there were only between three and four dozen undertakings (none of them local authorities) out of the many hundreds in the Provinces under these restrictions, had—apart from the scientific aspect of the question to which they had chiefly to give heed—some weight with them. The Provinces were, as a matter of fact, well represented at the Departmental inquiry by the enduring contentment of the hundreds of provincial cities and towns with oxide-purified gas.

It may be assumed that Counsel for the Newcastle Corporation put his best evidence before the Committee first; and, if so, that evidence was largely composed of the crudest of experiments. Against the sensitive olfactory organs of the gentlemen who made these experiments, and who, as is commonly the case in such circumstances as they found themselves in, set out to seek something and found it, may be placed the fact that, to the best of our knowledge, there has been no complaint from disinterested consumers in the Metropolitan area since lime purification was abolished by the three Companies, though, during these early days in the change of the system of working, the grains of sulphur compounds other than sulphuretted hydrogen have exceeded what will certainly be the case when the Companies settle down to definite lines of operation. Professor Vivian B. Lewes is a consumer of South Metropolitan gas; and he confesses to being a gentleman in whom the sense of smell is strongly developed. His recent experience as a consumer confirms his previous view, that lime purification is all a fad. Other large consumers of gas in various quarters of London observe no difference in the atmospheric condition of rooms or offices; nor do men working sometimes throughout the night at printing establishments.

The position taken up by Mr. E. H. Stevenson, who appeared on the opposition side, will not bear too close an examination.

He gave evidence in favour of the abolition of the sulphur restrictions on the South Shields Gas Bill, but now says that had he known there would have been occasionally temporary flights above what he considers would be a generous limit to the sulphur compounds, he would not have appeared on the side of absolute freedom. As an expert, Mr. Stevenson had at command, as he has now, the experiences of the gas undertakings throughout the country who have used nothing but oxide of iron for purification, had he chosen to consult them in the year of the South Shields Bill, to show what are the common results of their ordinary working. It is beside the mark to talk of this change in London being experimental. The experiment has been in the restriction of a few companies; and it has been adjudged absolutely useless by a competent tribunal of experts, and by that larger public tribunal of gas consumers who have never used anything but oxide-purified gas. Mr. Cawley's Committee only sat on Thursday, and then, for the convenience of the parties, adjourned until yesterday. What then transpired is briefly recorded in our "Parliamentary Intelligence," but will be more fully reported next week.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 327.)

THE Stock Exchange did not have a very bright time last week for many reasons. Anxiety and uncertainty regarding the effect and extent of San Francisco losses, similar anxiety as to how the Russian loan would go, sundry disagreeable political possibilities looming ahead, the weakness of American markets, &c., composed a formidable array. One or two failures over the settlement, though it was not a very heavy one, did not help to make things brighter; and at the close the general position was about as dull as at any time of the week. In the Money Market, the tendency was rather shifty. There was a fair demand for the Stock Exchange, and in view of the end of the quarter; but the supply appeared equal to the requirements. Discount rates were on the whole rather firmer. Business in the Gas Market aggregated a fair average amount; but it was not much distributed over the list, and was principally in the two largest Metropolitan Companies, both of which had a set-back. The tendency was downward all round, however, and what few changes were made quotations were adverse. In Gaslight and Coke issues, the ordinary was very quiet at first and steady; but on Wednesday it displayed weakness, and was more freely offered. This state of things continued up till the close; but the final prices were not the worst of the week. Figures at which transactions were marked ranged from 98⅛ to 96—a fall of 2⅛ in the quotation. The secured issues, too, were much more freely dealt in; and they had a fall of from 1 to 1½. The maximum changed hands at from 89⅜ to 87½; the preference at from 111 to 108; and the debenture at 88 and 89. South Metropolitan issues were similarly affected; the ordinary being marked at from 128 to 126 (a fall of 2 in the quotation), and the debenture at 88 and 81⅝ (a fall of 1). Commercials were very quiet and steady. The 4 per cent. was done once at 115; and the 3½ per cent. once at 111½. The debenture was not dealt in. The Suburban and Provincial group were, if possible, quieter than ever. Brighton "A" was done once at 164¼, and British once at 42½ (a fall of ½ in the quotation). Among the Continental Companies, the entire array of transactions was very moderate. About half-a-dozen of them were in Imperial, which changed hands at from 237 to 235¼ (a fall of 1 in the quotation). European fully-paid marked from 23½ to 23¾, and ditto part-paid 17 5/16. Union was not dealt in. Among the undertakings of the remoter world, Cape Town changed hands once at 16¾ (a fall of ¼), Buenos Ayres at 12½ and 12 11/16 (a fall of ¼), Primitiva ordinary at 7 7/16 *cum div.*, ditto preference at 5 7/16, ditto debenture at 98¾ and 99, and River Plate at 13⅛ *ex div.*

The closing prices are shown in our Stock and Share List on page 327.

An air-lift plant of unusual arrangement is employed at Des Plaines (Ill.). The water is taken from three wells, piped under the Des Plaines River, and discharged into a cylindrical reservoir over which the mechanical plant is installed. The discharge from each well is into a pipe with its mouth at such an elevation that the water flows by gravity to the reservoir; a vent-pipe being provided in the connection between the well and the discharge-pipe, so as to permit the escape of air. The entire installation furnished 270,000 gallons per day during a test.

Mr. C. E. De Rance, the Secretary of the Underground Water Committee of the British Association, has written to "The Times" to say that during the 23 years he has held his present position he has from time to time received the assistance of our contemporary in obtaining information from those who control public wells, or who have private wells of their own, as to whether they have noticed any variation of the water-levels; and he does so now in regard to the appalling catastrophe at San Francisco. In the case of a former earthquake, at a well at Braintree (Essex) the response was very marked which he obtained through his appeal. Some of our readers might be in a position to afford information through our columns.

ELECTRIC LIGHTING MEMORANDA.

Municipal Electricity Profits and the Rates—Extravagance in Public Lighting affects an Old Principle—Sound Finance and the Future—Low Public Lighting Costs where there is not Municipally Provided Electricity—The Lighting of Oxford Street—Marylebone's White Elephant.

THE Mayor of Hampstead is Sir George Barham; and to a representative of the "Standard," he lately—in connection with the criticism of the borough's finances in our contemporary's series of rates articles—made this observation: "My grievance is this, if we did our business with a private company, we should have our supply of electricity for less money." That is the grievance, but we must get to the cause before making comment. In the first place, it must be acknowledged that the financial policy of the Hampstead Council in connection with their electric lighting undertaking is one of the soundest to be found in connection with such concerns in the Metropolis; and it is because of this that there is a profit, part of which goes to the rates. That is the seat of Sir George's grievance. This year the electric light profits have contributed ½d. in the pound to the reduction of the rates all over Hampstead, besides paying £15,000 to £17,000 interest on the borrowed capital. His Worship does not think it fair that users of the electric light should have to pay interest on the money advanced, refund that money, and then contribute ½d. towards the reduction of the rates of those people who are gas consumers. With the principle of this contention we quite agree (with but one reservation) in its application to municipal trading generally. It has been our argument times beyond number in dealing with the question of the disposal of municipal gas profits; but municipalities have been just as much indisposed to hearken to us as they will be to fall in with the views of Sir George Barham. As between gas and electric lighting, however, there is a great gulf; and there is a stronger reason in connection with the latter why, if there is a profit fairly available for distribution, the ratepayers generally should have part. If there is any value in the public lighting load to the electricity undertaking, then the ordinary consumers must reap of that value; but it is the ratepayers without exception who pay the price of giving the undertaking the custom of public lighting by electricity, from which (as a street illuminant) they disproportionately gain benefit, if—and we do not admit it—benefit there be. Where the gas supply is municipal property (the argument applies equally where it is not), in the days when the public lighting was supplied throughout the borough by means of gas-lamps, the profit on the business was slender, and in some places had no existence. Any way such profit as there was, was only a fair earning on the service rendered.

Let us go back to the days of gas lighting in Hampstead. In 1888-9, the payment for public gas lighting (the gas being supplied by a Company) was £5351; and in 1899-1900, £8276—the difference representing a decade's development and improvement in the district. In the three succeeding years, there cannot have been very much development or improvement in the district; but municipal electric lighting came in, and the lighting of part of the streets was given over to the Electricity Department. Result, in 1903-4, the cost of lighting the streets of the borough was £11,658—an increase in three years of £3382! Who is paying this great difference? The electric lighting is confined to comparatively few streets, and is an extravagance. But for that lighting, the whole of the ratepayers are paying, though many of them live in streets remote from the scene of the lighting. If any one at all benefits from the extravagant lighting, it is only those ratepayers—mostly tradesmen, but not the whole of the tradesmen in the borough—who have shops in the main streets. We are firmly opposed to extravagance in public lighting as in all other departments of municipal work; but when, in any way, the whole of the ratepayers have to contribute to that extravagance, then we do say that, in fairness, they should participate if there is ultimately any profit to dispose of, after making adequate provision for the future of the undertaking. It is, however, to the credit of the Hampstead Borough Council that, at the present time, only the main streets of the borough are lighted by electricity; and to quote the writer of the "Standard" articles, "it is noteworthy and praiseworthy on the part of the Borough Council that, in some cases, they have abandoned electric lighting in the streets for incandescent gas." As a rule, when a municipality owns an electricity undertaking, there is present the temptation to extend electric lighting for the purpose of giving more business to their own "shop," and the more readily can they satisfy the aspirations prompted and promoted by jealousy to go one better than their neighbours whether or not they can afford it.

Remark has been made of the sound financial policy which the Hampstead Council have adopted in connection with the administration of their electricity undertaking. It would be passing strange if out of all the boroughs in the Metropolis owning electricity undertakings, there was not one which was well conducted. The writer in our morning contemporary points to this one as a notable exception to the general rule. The Council have come to the conclusion that the repayment periods allowed for their loans extend too far beyond the life of the plant. They have therefore equated the repayment terms to 24 years, and are liquidating their loans on that basis, in addition to which they

are setting aside considerable sums to reserve fund, the total of which at March amounted to £36,280. But all this is only done by a fair price being charged per unit, and in comparison with less financially sound undertakings the price is a very high one—the average being 4·08d. per unit. This brings us back to Sir George Barham's grievance—"if the Council did their business through a private company, we should have our electric light for less money." Signs are not wanting that the ratepayers and the electricity consumers of Hampstead will have ample cause to remember these words of Sir George. A fairly high price is an absolute condition to the preservation of the present sound financial policy, any departure from which policy will bring (as must inevitably be the case in any other borough) a heavy burden upon future generations of ratepayers. All round competition for business is forcing down the prices charged for electricity; and any supersession in future of the local undertaking in respect of industrial business by a power and bulk supply undertaking, will necessitate still further reduction. Again with the lowering of prices in other boroughs, and the expectation that those taking a supply in bulk later on will be able to sell at still lessened rates, the consumers of municipal electricity in Hampstead will not, when they make comparison, be pleased to continue to pay the high prices necessary to the financial stability of the undertaking. Sir George's grievance therefore looks as though it will be accentuated, instead of lessened, by future events. Electricity is proving itself day by day to be a business that had better have been left to private enterprise.

In the latest articles, we have the conclusive proof that those boroughs who are not burdened with electricity undertakings, although they may patronize electricity companies to a small extent, are the ones that are most cheaply lighted. Take Holborn, lighted by incandescent gas-lamps, the cost per mile is only £390; but Islington, with 20 miles of electricity and the remainder gas-lamps, pays an average of £525 per mile. What justification can there be for this difference? Finsbury, too, gets its streets lighted cheaper than those boroughs possessing electricity concerns; and yet Finsbury partially employs purchased electricity for the purpose. The cost has increased, however, though the area is smaller, under the re-arrangement of local government in the Metropolis. Notwithstanding, in 1903-4, the cost was £6730, as compared with £4796 in the case of Bethnal Green, with a larger area lighted by incandescent gas-lamps. Deptford again, spending £4294 on public lighting in 1899-1900, only expended £3847 in 1903-4; the streets of the borough being lit by the low-priced gas of the South Metropolitan Gas Company. The erection of additional lamps in 1904 and 1905 increased the cost to £4075 and £4500. Even then, it is observed, the price is not much more than it was five years ago—the improvements having been made possible without extra expense on five years ago by the cheapening of gas. The Council have not an electricity undertaking of their own; but there are councillors itching to abandon economy.

In view of such testimony as is here adduced as to the economy of incandescent gas lighting, it is not to be wondered at that, in a series of articles waging war, as do these in the "Standard," against municipal extravagance, prominence should be given to the decision of the Lighting Committee of Marylebone, notwithstanding the white elephant that the Council possess in their electricity undertaking, to recommend that the improvement of the lighting of Oxford Street should be by incandescent gas. We need not, at the moment, refer to this matter at length; seeing that the report of the Committee dealing with the subject appeared in our issue for April 3 (p. 54). The Council have yet to consider the question; but whatever their determination, that report is the issue of a most careful and painstaking investigation by the Committee, and—Oxford Street being known the world over—should certainly not escape notice by gas managers in the production by them of argument regarding the lighting of special streets and positions. Not only would the lighting of Oxford Street by gas be £329 cheaper than electricity per annum, but the Committee have come to the conclusion that, the incandescent gas-lights being so much nearer the pavement, "the lighting of the street will be more evenly diffused, and much more effective by this system than by electricity."

The mention of Marylebone's white elephant brings to mind the story of the grim financial burden imposed on the ratepayers by the Council's hankering after the part of the Metropolitan Electric Supply Company's undertaking supplying the borough with electricity. Up to the present, the undertaking has cost the ratepayers £2,003,538; but they have not yet felt the whole of the burden—the commencement of the sinking-fund having been deferred from the start of municipal management for three years. When the full interest and sinking-fund charges are in operation, as they will be a year hence, the cost to the ratepayers will be (the "Standard" states) £95,000 a year. The Engineer in 1903 estimated that there would be a surplus of £17,340 in 1906. But what has happened since then? His calculations were based on a capital expenditure at least £300,000 less than it has been; and he reckoned on an average price per unit of 5d. The prospects of the electricity consumers being content to pay 5d. in the future are not, to say the least, so bright as the Council could desire. Never has there in London been a municipal trading blunder so colossal as this; but "though it stands out by its monumental foolishness from other municipal attempts, it is still useful as an example." It is, however, the ratepayers of Marylebone who have to pay for this example to others; and they are not to be envied the privilege.

THE SLIDING-SCALE PROVISIONS.

An English View.

ABOUT this time last year, the President of the Boston Consolidated Gas Company of Massachusetts, accompanied by the Solicitor advising them, came over to this country to investigate various points in connection with gas legislation, and to examine, as exhaustively as possible, into the working of the standard price and sliding scale, with the view of obtaining the sanction of the authorities in America for their Company to be under somewhat similar legislation. Upon the advice of a well-known barrister with whom they were well acquainted, they applied to Messrs. Stevenson and Burstal for information upon the subject. In October, these gentlemen presented their report, and with the sanction of the President of the Company and by their courtesy, we are able to give it *in extenso*. It comes very opportunely as a sequel to the article which appeared in the "JOURNAL" last week; and it is with much pleasure that we bring it under the notice of our readers.

In accordance with your instructions, we are now in a position to report upon the comparative benefit or otherwise conferred upon the consumers of gas by the adoption of the standard price and sliding-scale in modern legislation in Great Britain; and in doing so we shall, as far as possible, set forth in detail various statements from which we hope you will be able to arrive at a definite conclusion.

Before dealing with the special points submitted for our investigation and report, it will, we think, be at least interesting to set forth a short history of the inception and growth of public opinion in favour of a sliding-scale of charge for gas.

The first suggestion as to a sliding-scale was made by Mr. J. Challice, the Medical Officer of Health for Bermondsey, in an inquiry held by a Select Committee of the House of Commons in 1858, in consequence of grave complaints from various bodies of gas consumers both as to the unsatisfactory manner in which, it was alleged, the Companies were carrying out their obligations and excessive charges for gas. Mr. Challice was the representative of a Society called the "South London Gas Consumers' Mutual Protection Society," which, with other groups of inhabitants of London, had petitioned Parliament for redress. This witness suggested that the Companies should be compelled to supply gas under a sliding-scale—the price being dependent upon the cost of labour, coals, and iron; or, in the words of a question addressed to him, "so as to make the price of gas dependent upon the cost of producing it." There does not appear to have been any suggestion that the Companies should be permitted to increase the dividends as they reduced the price of gas.

Another Committee was appointed in 1859, "to inquire into and report as to existing arrangements for the supply of gas to the Metropolis," and to whom the evidence taken the previous year was referred. This inquiry resulted in the introduction of a Bill into Parliament in the ensuing session, and the passing of an Act entitled the "Metropolis Gas Act, 1860." This Act sanctioned the districting arrangements, and fixed a reduced maximum price for gas; and to a certain extent incorporated the ideas of Mr. Challice as to a sliding-scale acting in concert with a rise in the cost of materials or labour. But very little resulted from this Act except better regulating the supply of gas; for the maximum price was still so high (4s. 6d. per 1000 feet) that, except in consequence of coal famine, such as occurred in 1872-3, there was no possibility of the price needing to be increased beyond it. There was then no incentive to the Companies to manufacture and supply gas at the lowest possible price.

Some slight good, however, was affected by the agitation, because in the cases of a few Companies coming to Parliament after this date, the Committees in fixing a maximum price also decided that the rate of profits which the Company could divide among the shareholders should be dependent somewhat upon the price of gas. These Companies were therefore granted a maximum price, and also a maximum rate of dividend of 10 per cent. per annum; but they were not permitted to divide the profit of 10 per cent. until the price of gas was reduced to a specified charge. For example: By the Great Grimsby Gas Act, 1867, the maximum price of gas was 4s. 6d. per 1000 feet, but the dividends were regulated as follows: 7 per cent. so long as the price charged exceeded 3s. 3d. per 1000 feet; 8 per cent. when the charge exceeded 3s. but did not exceed 3s. 3d.; 9 per cent. above 2s. 9d. and under 3s.; 10 per cent. when the charge was at or under 2s. 9d. By this means, to a limited extent, a sliding-scale of dividend was inaugurated; and one or two Companies—notably the Sheffield Gas Company—still work under this system. Although the Sheffield Gas Company is generally spoken of as a maximum-price and a maximum-dividend Company, as a matter of fact its dividends would be reduced if the price of gas were increased beyond 2s. 9d. per 1000 feet; and then, instead of being permitted to pay a dividend of 10 per cent., it would be limited to dividends of 8 per cent. on the old stock if the price exceed 3s. 6d., or 7 per cent. on the newer stock if the price exceeds 3s. 3d.

The question arose again in 1875, when the Metropolitan Board of Works—the predecessors of the London County Council—

introduced a Bill, entitled "The Metropolis Gas Companies Bill," for the further regulation of the Gas Companies. Clause No. 6 of the Bill proposed a price of 3s. 9d. per 1000 feet, with a reduction in dividend of 5s. per cent. for every penny or part of a penny charged in excess of the maximum price of 3s. 9d. This proposal did not offer any inducement to the Companies to supply gas at less than 3s. 9d. per 1000, and indeed would not have been of any greater benefit to the consumers than the ordinary practice of a maximum price. But it would have been of some possible benefit to the Companies by allowing them in times of stress to raise the price above the maximum and thus, at a slight reduction of their dividend, still be able to work at a remunerative profit.

During the hearing of the Bill, the Board of Trade made a report in which they advocated a standard price of 3s. 9d., with a sliding-scale of dividend working both up and down; and this commended itself to the judgment of the Committee, who embodied it in their amended Bill. Sir George (then Mr.) Livesey, in his address to the British Association of Gas Managers in 1874, suggested a somewhat similar scheme, but proposed a neutral zone of 1s., within which the price might rise and fall without altering the rate of dividend. He added: "I throw this out more as an illustration than a suggestion; for there are several plans by which the object might be obtained, and I hold it to be most strongly in the interest of gas shareholders, directors, and managers to heartily assist in carrying out some system whereby they may have their customers with them—some easily workable, self-acting arrangement that would put an end to the cat-and-dog life, and make them live and work in peace with each other—in fact, make it really to the interest of gas companies and gas managers to do the best they can for the consumers."

Two of the London Companies—namely, the Gaslight and Coke and the Commercial—were promoting Bills during the same session; and while the latter immediately revised their Bill to include all the new regulations, the former declined to do so, and not only withdrew their Bill but opposed that of the Commercial Company. The Imperial, the Phœnix, the Surrey Consumers', and the London Gas Companies also petitioned against the Bill—especially upon the point of the standard price and sliding-scale, but did not carry their opposition further. The Commercial Company was thus the first to obtain the modern system of a standard price and sliding-scale of dividend.

Referring now to the point upon which you have asked us specially to report, we desire to state that for all except the three London Companies, we have drawn chiefly for our facts upon the returns of "Statutory Gas Companies' Undertakings" made annually to Parliament since 1880. The first return is the earliest general information obtainable, and we have therefore used it as our starting point; for although we have particular knowledge of a large number of these undertakings, we consider that no true comparison can be made unless they are all treated, as far as may be, in a similar manner. The last return is for the year ending the 31st of December, 1903,* so that, with the exception of the three large London Companies, we are only able to carry our compilation to that date.

We have brought this information and deductions therefrom together in the form of appendices or statements which are annexed to this report. They are as follows:—

Appendix No. 1.—Statement showing the total number of gas companies working under a maximum price and maximum dividend in 1903.

Appendix No. 2.—Statement of gas companies working under a maximum price and maximum dividend that have not been to Parliament since 1878.

Appendix No. 3.—Statement showing the total number of gas companies working under a standard price and sliding-scale of dividend in 1903.

Appendix No. 4.—Comparison of prices charged in 1880 and 1903 by companies selling 100 million cubic feet of gas or more per annum in 1903, working under a maximum price and maximum dividend, and a further comparison of those that are now standard price companies from 1880 up to the date of the alteration.

Appendix No. 5.—Comparison of prices charged in 1880 and 1903 by companies selling 100 million cubic feet of gas or more per annum in 1903 working under a standard price and sliding-scale of dividend, excepting the three large London Companies; and a further comparison of those others that are now standard price companies from the date of alteration to 1903.

We desire to say that in Appendices Nos. 1 to 3 we have omitted all reference to those companies which supply both gas and water, where the capital for the two undertakings is not kept separate, as it is impossible to accurately allocate the capital to either the gas or the water undertaking. Several towns, therefore, are mentioned in Appendices Nos. 4 and 5 which do not appear in the first three.

It will be necessary to analyze Appendices Nos. 1 and 3 before any opinion can be formed from them, and before the results of their compilation can be compared.

First, as to Appendix No. 1. There are 235 places or undertakings in this list; but the British Gas Company owns five of them, and the Holyhead and North Wales Gas and Water Corporation owns four others—making 228 companies represented. A summary of the list presents the following facts:—

Number of undertakings	235
Quantity of gas sold in millions of feet	27,866·01
Average price charged for gas per company	3s. 10·09d.
Total capital employed	£16,660,210

This gives an average sale per undertaking of 118,528,000 cubic feet, and an average capital of £70,894. The capital employed per million feet of gas sold is £597·87. There are the three large undertakings in this group—Bristol, Liverpool, and Sheffield—whose average price of gas is 2s. 5d. per thousand feet and average capital £485·2 per million feet; and there are the five Companies—Sunderland, Rochester, Warwick, Kidderminster, and Worcester—who have made for many years, and still do make, all their extensions out of profits. These five Companies together sell 1798 million feet of gas, and have a total subscribed capital of £349,548, which works out at the extraordinarily low figure of £194·41 per million feet sold. But this does not represent the capital employed. The remaining 227 undertakings have a sale of gas amounting to 17,586 million feet, and a capital employed of £12,195,378, which is equal to £693·44 per million, and an average charge for gas of 4s. per 1000 feet.

Of the total number of 235 maximum price undertakings, 97 have not been to Parliament since 1878, and therefore have been unable to obtain the standard price. Of the remainder, 63 have not paid maximum dividends; and they therefore naturally prefer to remain as maximum dividend companies, in the hope that some time in the future they may be able to pay back-dividends under the powers of the Gas-Works Clauses Act, 1847. This leaves 75, of which 9 have been established in absolutely new districts, and therefore could not ask for a standard price, not knowing what their prospects would be. Thus there only remain the 69 prosperous companies which could have obtained the standard price had they wished to do so. We may say that six (6) of the 235 were changed to standard price in 1904 and some, but we do not know how many, in 1905.

Secondly, as to Appendix No. 3. The summary of this list shows the following:—

Number of companies	202
Quantity of gas sold in millions of feet	65,303
Average price charged for gas per company	3s. 5·81d.
Total capital employed	£35,711,722

To enable a comparison to be made between this list and that contained in Appendix No. 1, it is necessary to deduct all figures pertaining to the three London Companies, which are treated separately, thus making the summary—

Number of companies	199
Quantity of gas sold in millions of feet	30,374·23
Average price charged for gas per company	3s. 5·97d.
Total capital employed	£14,612,327

In this case, the result shows an average sale per company of 152,628,000 cubic feet, and an average capital of £73.429; while the capital employed per million feet of gas sold is £481·06.

Tabulating, therefore, very shortly, the results thus far obtained from Appendices No. 1 and 3, the following appears:—

	Maximum Price.	Standard Price.
Number of companies	235	199
Gas sold per company, cubic feet	118,528,000	152,628,000
Capital employed per company	£70,894	£73,429
Capital employed per million cubic feet sold	£597 87	£481·06
Average price charged for gas	3s. 10·09d.	3s. 5·97d.

The table shows that the average size of the companies is sufficiently nearly the same in both categories to admit of a fair comparison being made between them. The average capital employed per company is almost the same; but a much larger business is done with it in the "standard" price than in the "maximum" price companies.

The difference in price charged is rather more than 4d. per 1000 feet in favour of the standard price companies; and we are of opinion that the greater part of this difference is due to the reduced capital charge required by them in proportion to the business done. There can, we think, be very little doubt that, taking the two groups of companies each as a whole, it will be admitted that the inducement to earn higher dividends has had the effect of putting an end to all capital expenditure except such as is absolutely necessary. While it is comparatively easy to earn maximum dividends, there is no inducement to look carefully after capital expenditure; but when by a reduction in the price of gas increased profits can be divided among the shareholders, all capital expenditure is most carefully criticized and reduced to the lowest possible amount. Of course, this carefulness also applies to those maximum price companies which supply large business centres, and where it is absolutely necessary to supply gas at a very cheap rate; and it accounts for the low capital employed by some of them. The disproportion of capital expenditure is still more emphasized if the five Companies previously mentioned be eliminated, for it then amounts to £626 per million feet sold for the maximum price companies, and the capital per company rises to £70,916, while the gas sold falls to 113,339,000 feet.

We now turn to the next two appendices; and it will be seen that both are divided into two classes—viz., those that are of the same type in 1903 as in 1880, and those that have been altered

* It must be borne in mind that the report was made in October last year.—Ed. J. G. L.

since the latter date. Taking the former, it will be seen from the following table that again the standard price companies compare favourably with the maximum price companies:—

	Maximum Price. s. d.		Standard Price. s. d.
Average price of gas in 1880	3 4·77	..	3 6·88
,, ,, ,, 1903	2 8·80	..	2 7·70
Average reduction in price per company	0 7·77	..	0 11·18
,, ,, per annum . . .	0 0·347	..	0 0·484

This table shows that during the 23 years the average reduction in price per company in Section A of Appendix No. 4 was 7·77d. per 1000 feet, while during the same period 11·18d. was the average reduction among the companies included in the corresponding section of Appendix No. 5; the difference in favour of the latter, or standard price companies, being 3·38d. It is true that this does not appear to be a large difference; but the total saving to the consumers of these 17 companies amounts to the big sum of £127,764 on one year only, while if the other 49 companies had made a similar reduction the consumers would pay £320,368 less per annum.

Whereas in 1880 the standard price companies charged 2·11d. more than the others, they now charge 1·10d. less; while they pay much higher dividends—being in one case 4 per cent. in excess of the standard. This is not due to having less capital for the business done, for the 16 standard price companies have an advantage of only £18 per million cubic feet of gas sold over the maximum price companies; neither are the former in any better situation for obtaining coal or any other advantage than the latter, nor of much larger average size. It must, therefore, be by economy of working that these particular companies pay higher dividends while charging less for gas.

If the latter section of the tables be taken, it does not appear that the comparison is particularly favourable to the standard price companies, but it should not be forgotten that it is much easier to make reductions from an original average price of 3s. 10·47d. than it is from a price of 3s. 5·34d.; and therefore, although the reductions per company and per annum are practically the same, it does require closer working and more careful management to bring about a reduction of 5·84d. in the latter period than 5·76d. in the former and at the same time to increase the dividends. We therefore think it may fairly be argued, even in this case, that an advantage has accrued to the consumer by the changed conditions under which the companies now work.

The London Companies.

In looking at these three Companies, it is possible to deal more closely with the facts than with those of all the other companies in general, because we are furnished with "Field's Analysis" of the London Companies from 1869 to 1904—a period of 36 years; and all the figures embodied in this part of the report have been taken from this publication.

Originally there were 13 Companies supplying London; but they resolved themselves, by process of amalgamation, into the three Companies as they exist to-day—the Gaslight and Coke Company absorbing seven, the Commercial Company combining with the Ratcliff, and the South Metropolitan Company taking in the two that with them exclusively served London on the south side of the river within the area of the Metropolis. The Gaslight and Coke Company now supplies nearly the whole of the north side of London (the Commercial Company supplying only a small district) and a small portion of the south side; and the South Metropolitan Company supplies nearly the whole of the remainder of the south side. This process of amalgamation was completed in 1882; so that 1883 was the first year of working under the existing state. The figures for 1869 include all the Companies now forming the three except the Western Gas Company, which before amalgamation supplied only cannel gas; and we consider that the figures as to the price of gas are not applicable. But we have included all the Companies in 1876, for then the Gaslight and Coke Company was as it now is, except for the district supplied by the London Company.

We will deal with each of the Companies in turn in the following order: (1) The Gaslight and Coke Company, (2) South Metropolitan Company, and (3) Commercial Company.

The Gaslight and Coke Company.

In dealing with this Company, it must be borne in mind that it has always been handicapped by having a large capital for the business done, and that it serves the most wealthy business and residential portion of London—that part in which the principal theatres are situated. We mention this latter because it has therefore met with the most severe competition from electric light undertakings, and has lost a very large number of the best consumers, who have changed from gas to electric lighting, and who either did not mind paying for the luxury of a more convenient form of artificial lighting, or to whom it was necessary, from a business point of view, to follow the tastes and wishes of the public. Thus, while they have been gaining business in the suburbs, they have lost the more profitable business of some of the closely-populated and strictly urban portions of their district, with the result that during the last 21 years they have only increased their sale of gas to the extent of 42 per cent. The competition was not appreciable until about 1890; and we consider that the figures we shall give later will show that until this competition became effective, the Company held their position very fairly. They have also been obliged to abandon some of the works originally erected in closely-populated districts, and have not, unfortunately, written off the dead-capital.

The capital of this Company consists to a large extent of the capital stocks of the different Companies which are now combined under the title of "The Gaslight and Coke Company," and which was raised before the auction clauses came into operation; so that of the total capital of £13,897,308 employed, the large amount of £6,225,000 carries a maximum or standard dividend of 10 per cent., £60,000 of 7½ per cent., and £1,300,000 of 7 per cent. This is altogether exclusive of other capital which nominally carries 10 per cent. dividend, but which, being issued under the auction clauses, probably only returns 4½ per cent. or 5 per cent. to the shareholders. From this it will be seen that nearly half the capital bears 10 per cent., and that more than half carries an average dividend of about 9⅛ per cent. This does not, however, fully account for the fact that in 1904 the charge per 1000 feet of gas sold required to pay the standard rate of dividend amounted in the case of this Company to 9·71d., while the South Metropolitan only required 5·01d.; for we find that while in 1904 the charge due to the standard rate of dividend of the Company was 4·7d. per 1000 feet in excess of that required by the South Metropolitan Company, in 1883 it was only 0·97d. So that other and more important causes must have been at work. One of these causes must be that the Company have had to expend capital to meet the demands of the suburbs and also to provide prepayment meters and fittings to the small consumers in the older parts of their district, while other capital went out of profitable occupation. We need not elaborate the point to you that a much larger proportion of capital is required to supply small consumers or districts on the outskirts than to supply the large ones in the denser parts of the area; and although this applies to all companies, yet it is accentuated in this case by the loss of so many of the better class.

We have mentioned all these matters because we consider the present position of this Company should not cast a reflection upon standard price companies generally; for if our investigation had stopped at 1890, when the competition mentioned was first felt, everyone would be of opinion that consumers served by the Company had benefited by its conversion into a standard price undertaking equally with those served by other Companies.

The capital of the Company was in 1869, before any amalgamation took place, at the rate of £1015 per million cubic feet sold, and in 1883, largely by the process of amalgamating with other companies having a lower rate of capital, was reduced to £724 per million. This has been further reduced in 1904, by more judicious expenditure of capital, and probably by bringing into operation works not then in use, to £659 employed per million feet sold. The capital was increased by 30 per cent. to cope with an increase of business of 42 per cent. Thus the business of the last 21 years has been accomplished by an expenditure of just over £500 per million feet.

In comparing the prices of gas through a series of years, one should, as far as possible, take into consideration to what extent it is reduced or increased by circumstances over which a company can have little or no control. In our opinion, the only matter coming under this head in the case of a gas company is the cost of coal; and we are able, from "Field's Analysis," to show what this has been. In the following table, we have dealt with the figures every seventh year up to 1890, because the first period embraces the time when the Company worked under a maximum price; and we consider that, to obtain the best comparison, further periods of seven years should be taken under the altered conditions. We have stopped at 1890, partly because of the unsettlement of the coal market, and partly because any difference of policy due to the altered conditions would by that time have become apparent; but we have given the final figures of 1904, as they show the result of the last fourteen years' working.

Year.	Average Price of Gas.	Reduction (−) or Increase (+) in Price of Gas.	Average Net Price of Coal.	Reduction (−) or Increase (+) Due to Coal.	Reduction (−) or Increase (+) Due to Other Causes.
	d.	d.	d.	d.	d.
1869 . .	47·87	..	14·48	..	..
1876 . .	44·93	− 2·94	8·26	− 6·22	+ 3·28
1883 . .	37·87	− 7·06	6·40	− 1·86	− 5·20
1890 . .	31·36	− 6·51	7·63	+ 1·23	− 7·74
1904 . .	34·36	+ 3·00	4·82	− 2·81	+ 5·81
	Totals. .	− 13·51	..	− 9·66	− 3·85

This shows that the reduction in the price of gas in the seven years preceding the alteration was 2·94d.; while for the fourteen years after it was 13·57d., or 6·78d. in each of the seven years. But if the net price of coal be taken into account, it appears that the price was raised 3·28d. in the first seven years, and reduced 12·94d. in the second period of fourteen years. Quite recently, the price was raised consequent upon the increase in the cost of coal in 1900, and it is gradually coming down; but it is still 3d. per 1000 feet higher than in 1890.

South Metropolitan Company.

This Company is the most prosperous of all the London Companies. Its district did not include any wealthy areas similar to

those on the north side of the river, but there were very large tracts of land either unbuilt upon or occupied by large houses and grounds, and which are now mostly covered with buildings. It thus occupied the very satisfactory position of having a rapidly-expanding business, and was not subject to such keen competition as its large northern neighbour. It was therefore able to carry out at greater ease the ideas of its Chairman, Sir George Livesey, quoted in the earlier pages of this report.

In 1869, before any amalgamation had taken place, the capital employed was at the rate of £505 per million feet sold; in 1883, it was at the rate of £553; and in 1904, of £436. The rate of increase in this undertaking during the last twenty-one years has been 177 per cent.; while the capital expended increased by 136½ per cent., and has been at the rate of £394 per million feet.

The following table and that relating to the Commercial Company (*past*) are on exactly similar lines to the table already given in reference to the Gaslight and Coke Company :—

Year.	Average Price of Gas.	Reduction (−) or Increase (+) in Price of Gas.	Average Net Cost of Coal.	Reduction (−) or Increase (+) Due to Coal.	Reduction (−) or Increase (+) Due to Other Causes.
	d.	d.	d.	d.	d.
1869 . .	45·74	..	10·08	..	..
1876 . .	40·68	− 5·06	7 93	− 2·15	− 2 91
1883 . .	33·69	− 6·99	4·47	− 3·46	− 3·53
1890 . .	26·80	− 6·89	5·39	+ 0·92	− 7·81
1904 . .	24·08	− 2·72	2·42	− 2·97	+ 0·25
	Totals . .	− 21 66	..	− 7·66	− 14·00

The above shows that during the seven years' working under the maximum price, the charge for gas was reduced 5·06d.; while during the next fourteen years it was further lowered by 13·88d., or an average of 6·98d. per 1000 cubic feet in each period of seven years. If the last column be taken as the true criterion, it will be found that the first period only gave a reduction of 2·91d., while each of the other two periods averaged 5·67d. This Company, as well as most others, raised the price during the recent coal famine, but has now reduced it to the lowest figure it has ever charged.

Commercial Company.

This Company serves a district different in every respect from the two others. It is, and has been for a very long time, fully covered with buildings, consisting of warehouses, workshops, shops of somewhat poor character, and dwellings for the working classes; and there has been no possibility of extension, as it is surrounded either by the district of the Gaslight and Coke Company or by the River Thames and Bow Creek. It has therefore had to encounter difficulties which have not been met with by either of the other Companies; added to which it was not until 1902 under any obligation to sell capital at auction, but has allotted it among its shareholders. This probably accounts for the fact that while in 1883 it required 1·68d. less per 1000 cubic feet than the South Metropolitan Company to pay the standard rate of dividend, in 1904 it required 1·17d. more.

In 1869, the capital employed by the Commercial Company only was at the rate of £663 per million feet sold; in 1876, directly after the amalgamation, it was £565; while in 1883 it had been reduced to £468, and in 1904 to £448, per million. The rate of increase in business has been 82 per cent. in the twenty-one years, and the increase in capital 73 per cent., and has been at the rate of £423 per million feet sold.

The following table shows the reduction in the price of gas :—

Year.	Average Price of Gas.	Reduction (−) or Increase (+) in Price of Gas.	Average Net Price of Coal.	Reduction (−) or Increase (+) Due to Coal.	Reduction (−) or Increase (+) Due to Other Causes.
	d.	d.	d.	d.	d.
1869 . .	49·09	..	13·27	..	..
1876 . .	44·80	− 4·27	11·19	− 2·08	− 2·21
1883 . .	33·98	− 10·82	7·47	− 3·72	− 7·10
1890 . .	28·03	− 5·95	4 38	− 3·09	− 2·86
1904 . .	28·68	+ 0·65	5·62	+ 1·24	− 0·59
	Totals . .	− 20·41	..	− 7·65	− 12·76

This table shows that the Company also took the same line of larger reductions after the alteration than before; and although it became a standard price Company in 1875, we have adhered to the periods of seven years, so as to make comparison with other companies more easy. As a matter of fact, the prices of gas in 1875 and 1876 were practically identical. There was a reduction of 4·27d. in the years 1869-76, and of 16·77d. in the next fourteen years. Taking the final figures, the former was 2·21d. and the latter 9·96d.; being more than twice as much as in the pre-standard days. These results speak volumes for the management of an undertaking in such a district of supply.

If it be remembered that in 1876 the South Metropolitan started with a price of gas 4d. less than either of the other two Companies, we think it cannot be denied that, in both economy of capital expenditure and in reductions of price of gas, it did the best; and if the average prices charged in 1904 be compared, the reduction in the price of gas since 1876 places it at the head on both points. These reductions in 1904 amounted to—

Gaslight and Coke Company	10·55d.
South Metropolitan Company	16·60
Commercial Company	16·49

A brief summary of the foregoing figures may be of use :—

—	Gaslight and Coke Company.	South Met. Company.	Commercial Company.
Capital per million—			
In 1883	£724	£553	£468
In 1904	659	436	448
On increase of business . .	505	394	423
Reduction or increase in price of gas, 1869–76	− 2·94d.	− 5·05d.	− 4·27d.
Reduction or increase after allowing for coal.	+ 3·28	− 2·91	− 2·21
Reduction in price of gas, 1876-90	− 13·57	− 13·98	− 16·77
Do., after allowing for coal . .	− 12·94	− 11·34	− 9·96

You instructed us to report upon this matter with an open mind, so as to ascertain, or to lay facts before you from which you could judge, whether "the sliding-scale worked to the advantage of the consumer." We have abstracted the figures from the returns to Parliament without the slightest knowledge of what they would prove; though we, like many others, held the opinion that the sliding-scale was of benefit to the consumer, but without having the data to prove it. We consider that the figures and statements we have given you furnish sufficient data from which just conclusions may be drawn. The data very briefly are—

1.—A million feet sold by maximum price companies throughout the country takes a capital of £598, or £626 if the five Companies be omitted.

2.—A million feet sold by the standard price companies throughout the country (excepting the London Companies) takes a capital of £481.

3.—The standard price companies charge 4·12d. less per 1000 feet of gas on the average of prices.

4.—The average reduction in price per company from 1880 to 1903 of those companies selling more than 100 millions and working under the sliding-scale was 3·41d. in excess of the reduction made by the maximum price companies.

5.—In London the price of gas was reduced at a much more rapid rate in the fourteen years after, than in the seven years before, the change.

We are therefore satisfied that the view is correct that is held by so many people, that the giving of an inducement to the companies to provide gas at the cheapest possible rate has had a beneficial effect upon the consumers.

As mentioned in the report, Messrs. Stevenson and Burstal brought together the information contained in it, and the deductions therefrom, in the form of appendices or statements which were annexed to the document. They contain a mass of most useful tabulated matter; but it is sufficient for our purposes to present it in the form of summaries.

APPENDIX NO. 1.—*Gas Companies Working under a Maximum Price and Maximum Dividend in* 1903.

Number of undertakings	235
Gas sold in millions of cubic feet	27,866·01
Gas sold per undertaking in cubic feet.	118,528,000
Total capital employed	£16,660,210
Capital employed per undertaking	£70,894
,, ,, per million feet sold.	£597·87
Average price of gas per undertaking per 1000 cub. ft.	3s. 10·09d.

APPENDIX NO. 2.—*Gas Companies Working under a Maximum Price and Maximum Dividend that have not been to Parliament since* 1878.

Number of undertakings	96
Gas sold in millions of cubic feet	6012·18
Gas sold per undertaking in cubic feet	62,627,000
Total capital employed	£3,290,243
Capital employed per undertaking	£34,273
,, ,, per million feet sold.	£547·27

APPENDIX NO. 3.—*Gas Companies Working under a Standard Price and Sliding-Scale of Dividend in* 1903.

Total number of undertakings . . .	202	
Deduct for London	3	
Net		199
Gas sold in millions of cubic feet . .	65,302·92	
Deduct for London	34,928·69	
Net		30,374·23
Total of all the prices charged . . .	703s. 9d.	
Deduct for London	7 8	
Net		696s. 1d.
Total capital employed	£35,711,722	
Deduct for London	21,099,395	
Net		£14,612,327
Gas sold per undertaking in cubic feet		152,628,000
Average price of gas per undertaking		3s. 5·97d.
Capital employed per undertaking		£73,429
Capital employed per million feet sold.		£481·06

APPENDIX No. 4.—*Comparison of Prices Charged in* 1880 *and* 1903 *by Companies Selling* 100 *Millions or More per Annum in* 1903, *Working under a Maximum Price and Maximum Dividend* (A); *and a further Comparison of those that are now Standard Price Companies from* 1880 *to the Date of the Alteration* (B).

A.—MAXIMUM PRICE COMPANIES, 1903.

Total number of undertakings		48
Gas sold in millions of cubic feet		22,748
Total of all prices charged in 1880		163s. 1·35d.
,, ,, ,, ,, 1903		131 2·45
Total reduction in price	32s. 0·9d.	
Less increase in one company	0 2·0	
Net		31 10·9
Average reduction per annum	16·75d.	
Less increase	0·09	
Net		1 4·66
Average price of gas in 1880		3 4·77
,, ,, ,, 1903		2 8·80
,, reduction in price		0 7·77
,, ,, per annum		0 0·347

B.—MAXIMUM PRICE COMPANIES TO DATE OF ALTERATION.

Total number of undertakings		37
Gas sold in millions of cubic feet		16,015
Total of all prices charged in 1880		143s. 3·50d.
Do. at date of alteration		125 6·25
Reduction in price during period	18s. 4·25d.	
Less increase in two companies	0 7·00	
Net		17 9·25
Average reduction per annum	1 9·70	
Less increase	0 0·62	
Net		1 9·08
Average price of gas in 1880		3 10·47
Do. at date of alteration		3 4·71
Average reduction during period		0 5·76
,, ,, per annum		0 0·57

APPENDIX No. 5.—*Comparison of Prices Charged in* 1880 *and* 1903 *by Companies Selling* 100 *Million Cubic Feet of Gas or More per Annum in* 1903, *Working under a Standard Price and Sliding-Scale, excepting the Three London Companies* (A); *and a Further Comparison of those that are now Standard Price Companies from the Date of Alteration to* 1903 (B).

A.—COMPANIES ALTERED BEFORE 1880.

Total number of undertakings		17
Gas sold in millions of cubic feet		9072
Total of all prices charged in 1880		60s. 8·95d.
,, ,, ,, ,, ,, 1903		44 10·92
,, reduction in price during period		15 10·03
,, ,, ,, per annum		0 8·21
Average price of gas in 1880		3 6·88
,, ,, ,, ,, 1903		2 7·70
,, reduction in price		0 11·18
,, ,, ,, per annum		0 0·484

B.—COMPANIES ALTERED SINCE 1880.

Total number of undertakings		42
Gas sold in millions of cubic feet		18,026
Total of all prices charged at date of alteration		144s. 8·25d.
,, ,, ,, ,, in 1903		124 3·00
,, reduction in price during period	21s. 6·25d.	
Less increase in four companies	1 1·00	
Net		20 5·25
Total average reduction per annum	2s. 1·79d.	
Less increase	0 3·64	
Net		1 10·15
Average price at date of alteration		3 5·34
,, ,, in 1903		2 11·50
,, reduction during period		0 5·84
,, ,, per annum		0 0·527

EDUCATION AND TRAINING OF ENGINEERS.

IT will probably be within the knowledge of some of our readers that on the 24th of November, 1903, the Council of the Institution of Civil Engineers appointed a Committee "to consider and report . . . as to the best methods of training for all classes of engineers, including both scholastic and subsequent technical education;" an instruction to the Committee being that the principle should be maintained that the education of an engineer must include "both practical experience and scientific training." In taking this action, the Council proceeded on lines which had been followed for a long period with a view to improvement in the training and status of civil engineers. An exhaustive inquiry was made in 1868 into then existing conditions and systems of engineering education in the United Kingdom and in foreign countries; and the results were published by the Institution in 1870. In 1891, another statement was issued dealing fully with the facilities for engineering education afforded at that date by the engineering schools of universities and colleges in the British Dominions. The educational qualifications required of candidates for admission as students in 1889, and subsequently the system of examinations established in 1897 for students and associate members of the Institution, furnished further proof of the importance attached by the Council to the higher education of civil engineers.

During the year 1903, renewed discussions of the subject took place at the Engineering Conference of the Institution and at meetings of important engineering societies. While showing wide differences of opinion as to the best methods of training engineers, they indicated a general feeling in favour of thorough investigation of the subject by some body representing all branches of engineering, whose conclusions would command the attention of all who were interested in the question. This general desire was definitely expressed in a letter addressed by the President of the Institution of Mechanical Engineers to the President of the Institution of Civil Engineers, stating that the Council considered it desirable that a representative Committee should be appointed by the latter body to consider and report on the whole subject. This suggestion was the immediate cause of action of the Council later in the year, when a movement was made in the direction suggested.

The first step taken was to request the principal engineering societies—among others the Institution of Gas Engineers—to assist the proposed inquiry by nominating representatives to serve upon the Committee. They all complied with the request—Mr. H. E. Jones, as President for the year of the Institution just named, representing that body. By February, 1904, the Committee was completed, with Sir W. H. White, K.C.B., a Past-President of the Institution of Civil Engineers, as Chairman, Dr. Tudsbery, the Secretary of the Institution, as Secretary, and Mr. J. G. Henderson, B.Sc., as his assistant. As the members of the Committee were busily occupied and widely scattered over the country, it was felt that much of the work must be done by correspondence, and that it would be advantageous, before meetings took place, to settle the heads under which the inquiry might be arranged most conveniently. For this purpose a memorandum was prepared and circulated to the members of the Committee, setting forth the proposed sections of inquiry. They were: (1) Preparatory education in secondary schools; (2) training in offices, workshops, factories, or on works; (3) training in universities, and higher technical education; and (4) post-graduate work. The inquiry under the first head was to be directed specially to the suitable training—in mathematics, elementary science, modern languages, and handicrafts—of youths intended for the engineering profession. Under the second head, the possibility was to be considered of giving to the preliminary stages of a youth's practical training as broad a character as possible, so as to prepare him for any branch of engineering he might subsequently enter. With regard to the third head, it was suggested that opinions should be formed as to (*a*) the most suitable age at which average students could begin the course; (*b*) the possibility of arranging the earlier courses of study so as to be common to all branches of engineering; (*c*) the duration of such common courses of study; and (*d*) the extent to which specialization should be provided for in technical institutions, and the length to which it should be carried. As to the last heading, the Committee were invited to consider how post-graduate work could be best organized and maintained at universities and higher technical institutions as well as on actual works and in mines, factories, &c. At their first meeting, the Committee approved of this memorandum, and its consideration was proceeded with.

In prosecuting their inquiries, the Committee thought it essential to obtain, either orally or in writing, the opinions of persons having experience in engineering education, and of eminent engineers practising in various branches of the profession. It was desired to make this record of opinion precise, representative, and comprehensive; and for this purpose members of the Committee undertook to suggest the form in which inquiries should be framed, to give the names of those to whom application might be made, and to indicate general detailed action, which, in their judgment, would be of value in the collection of opinions and information. These suggestions were summarized and condensed, under the supervision of the Chairman, by the Secretary and Assistant-Secretary. The schedules of questions approved by the Committee and subsequently issued were prepared on this basis. These preliminaries necessarily occupied a good deal of time and entailed a large amount of correspondence; but the Committee were of opinion that it would not have been possible in any other way to secure equally full consideration of the subject, or so valuable a mass of information and opinion in regard to the principles it was desirable to follow in the training of engineers. The results of the Committee's labours have been fully set forth in a long report which was adopted by the Council of the Institution at their meeting last Tuesday.

Taking first the inquiry as to preparatory education, a schedule of questions was issued to 120 representatives of the following classes: (1) Teachers in engineering colleges; (2) head masters of secondary schools at which it was believed special attention was paid to scientific training; and (3) engineers not engaged in teaching. Replies were received from 80 per cent. of the gentlemen whose opinions were invited; and from these replies definite conclusions were deduced as to the prevalent opinions on the different points raised. These conclusions led the Committee to submit eight recommendations, the principal features of which are as follows: A boy intended for the engineering profession should, before leaving school, have attained a standard of education equivalent to that required for the Institution studentship,

and should not commence specializing till he is seventeen. A leaving examination for secondary schools, similar to that already existing in Scotland and Wales, is desirable throughout the United Kingdom. Advanced teaching of history and geography, with instruction and practice in essay and *précis* writing, should be included in the ordinary school *curriculum;* and the instruction in English subjects should include at least an introduction to English literature. Greek should not be required; but an elementary knowledge of Latin is desirable. Modern languages, especially French and German, should be studied, and should be taught colloquially, or in such a way as to give the pupils a practical knowledge of each language, sufficient to enable them to study its literature and to converse in it with some degree of facility. Instruction in mathematics should be given by methods differing considerably from those that are usually adopted in the teaching of this subject merely as an intellectual exercise. The geometrical side of mathematics should be fostered. It is also of importance that instruction in practical arithmetic should be carried farther than has been generally the case hitherto, with the object more especially of encouraging the use of contracted methods and operations in mental arithmetic. It is preferable that boys should attain at school a general knowledge of elementary physics and chemistry, rather than that they should pursue in detail some particular department of science. Special attention should be given to drawing; the instruction to include practical mensuration. Work in the nature of handicraft—such as carpentry or turning, or elementary field surveying—might be encouraged as a recreation, but should not be required as a school exercise. The Committee recommend that this scheme of preparatory education should be officially communicated to the Board of Education, and widely circulated among those engaged in the conduct of secondary schools and engineering colleges, in order that future schemes of tuition of youths who contemplate entry into the engineering profession may be guided thereby.

The Committee next take up the subject of engineering training. They desired primarily to ascertain the views of men whose opinions were entitled to respectful consideration, in consequence of their experience and study of education and of engineering training. Each member of the Committee was at liberty to forward the names of gentlemen to whom schedules should be sent; and each of the Institutions represented on the Committee was asked officially to suggest names, in order that all departments of engineering might be adequately represented. The total number of schedules issued was 676, and 267 were returned. To gas engineers 94 were sent, and 39 replies were received. An analysis of the replies, given in an appendix, shows that the tentative suggestions and recommendations embodied by the Committee in their schedule received very general support. A few correspondents expressed radically different views; but, in the main, the opinions of the Committee were endorsed. This result is satisfactory, since it indicates the possibility of practical effect being given to their recommendations. Of these there are twelve, the chief points of which we will summarize, as in the case of those relating to preparatory education.

In the first place, the "average" boy—and by this term the Committee mean a boy of ordinary ability, whose parents are in a position to secure for him a thorough training before he begins his actual work as a professional engineer—should leave school when he is about seventeen years of age. His practical training should be divided into two parts, whenever possible; and the preliminary stage should consist in all cases of at least a year spent in mechanical engineering workshops. During this training, boys should keep the regular working hours, be treated like ordinary apprentices, be subject to discipline, and be paid wages. Nothing should be done in the form of evening study, as this would impose undue strain upon the *physique* of boys. At the same time, those who so desire, and are physically fit, should not be discouraged from adding to their knowledge either by private study or by attendance at classes. As a rule, it is preferable to proceed to a technical college or university on the completion of the introductory workshop course. For the average student, the period of college study should be three sessions, provided he is well prepared before entering. In all cases, the first session might be advantageously devoted to a common course of study by average students; and probably this might be extended into the second session without loss to final specialization. A sound and extensive knowledge of mathematics is necessary in all branches of engineering; and the Committee endorse the practically universal recommendation, made by those whose special knowledge and experience entitle them to speak with authority, that sufficient time should be allotted to the study of pure mathematics during the common college course to permit the best students to obtain a sound knowledge of algebra, trigonometry, analytical and practical plane geometry, the elements of solid geometry, and a working knowledge of the differential and integral calculus, and of the simpler differential equations. To this fundamental mathematical training there must be added instruction in applied mathematics and mechanics. With regard to the teaching of geometrical drawing, physics, chemistry, and geology, the existing arrangements of the universities and technical colleges appear to be satisfactory and to meet all cases.

The Committee consider that at least three to four years should be spent in practical training, inclusive of the "introductory workshop course" previously mentioned. They favour a total period of four years' practical training in works, where it can be secured; and they think it is highly desirable that a part of it should be obtained in the drawing office. Where college training is completed before practical training is taken, the total period devoted to the latter should be three years in ordinary cases. Exceptional ability may justify a somewhat shorter period. The hours of work should be the same as if the usual course were followed; and the wages paid should be somewhat higher, especially in the later years.

The Committee strongly recommend efficient instruction in engineering drawing, in testing materials and structures, and in the principles underlying metallurgical processes and other practical operations incidental to the branch of engineering in which a student proposes to specialize.

In connection with the grant of degrees, diplomas, and certificates to engineering students, the Committee think considerable importance should be attached to laboratory and experimental work performed by individual students, as well as to their progress in mathematical and scientific studies; and they are of opinion that degrees, &c., should not be granted on the results of terminal or final examinations alone. Practical unanimity is shown in regard to this procedure by those whose opinions were obtained; and it is considered to be of great importance in assessing the professional attainment of students. Facilities for, and organization of, post-graduate work by engineering students in universities and higher technical institutions should be greatly increased. This recommendation is made by the Committee with the special object of encouraging qualified students to undertake researches which may prove of practical value to engineering operations and processes. The number of such students is not likely to be large at any time; but their influence on younger students should be highly beneficial, and the advantage to engineering and industry would in all probability be considerable.

The last point submitted by the Committee was to the effect that the improvement of engineering education depends greatly on the attitude of employers towards the suggestions foreshadowed in their memorandum; and they especially urged upon employers the importance of extending facilities to engineering students for the prosecution of post-graduate work. Of the total number of comments sent in on this opinion, 74 per cent. were in agreement; and the Committee conclude their recommendations by reaffirming their conviction that the sympathetic assistance of employers is essential to secure improvement in the training of engineers.

OBITUARY.

ROBERT PEAKE KEYS.

We regret to announce the death, on the 21st ult., at his residence "Wharncliffe," Devonshire Road, Honor Oak Park, S.E., of Mr. Robert Peake Keys, who for 28 years held the secretaryship of the West Kent Gas Company—a position which he relinquished just five years ago—being succeeded by his son, Mr. R. S. Keys. In recognition of his faithful service, he was granted a retiring allowance equal to two-thirds of his salary, and it was accompanied by the expression of sincere wishes, alike by Directors and shareholders, that he might live long to enjoy his well-earned rest. His health remained fairly good till about a month ago, when he had a paralytic seizure; and though he rallied for a few days, he succumbed to it and passed away in his 82nd year. Mr. Keys was a native of Dover, of which he was an "ancient freeman;" and in a booklet published by him about two years ago, and noticed in our columns at the time, he recorded some interesting reminiscences of the town, which is the most prominent of the Cinque Ports. In the course of his review of the political, social, and religious history of his birthplace, of which he was naturally proud, he referred to the original gas and water works, of which his uncle, Mr. James Peake, was Manager. Mr. Keys was known by name to many of our readers in connection with his "Meter Life Book," which he revised and adapted for slot-meter registration, and which has been found very useful. He will also be remembered by some for the vigorous attacks he made in our "Correspondence" columns on the oil lighting at Erith and Wimbledon some few years ago. He joined the British Association of Gas Managers in 1876, remained with that body as the Gas Institute, and passed with them into the Institution; but he did not take a prominent part in their proceedings. He was a thoroughly conscientious man; and our regret at the announcement of his death will, we are sure, be shared by a large number of private and business friends.

The death occurred recently, at his residence in Bath, of Colonel Robert Lewis Taylor, C.B., the Chairman of the Bath Gas Company. He was elected a Director on Jan. 7, 1881; and was chosen for the Chairmanship on March 6, 1901, taking the position up till then held by Alderman R. D. Commans. He took a great interest in the affairs of the Company from the time he joined the directorate, and was always most diligent in his duties. He had also been for many years identified with several local public bodies. Deceased was the third son of Mr. James Taylor, of the Bombay Civil Service, and was born in 1822. He entered the Bombay Army in 1838, and, after much active service, and filling several important positions, he retired as Colonel in 1865.

STATUTORY REQUIREMENTS FOR THE TESTING OF ILLUMINATING POWER.

By Harold G. Colman, Ph.D.

The new testing clauses proposed by the Chairman of Committees of the House of Lords for insertion, where practicable, in all Bills before Parliament, suggested as they are with the object of ensuring uniformity in this respect throughout the country in place of the chaos now existing, deserve to receive the most favourable consideration. There is hearty agreement by all with the object aimed at, and the only difference of opinion is as to whether the proposed clauses are the most suitable that can be drafted to attain the desired end. On this point I propose to offer some observations supplementary to those contained in the editorial article in the last issue of the "Journal."

In the determination of illuminating power, the three essential points are: (1) The standard of light; (2) the standard burner for the gas, and the exact method of its use; and (3) the method adopted to determine the relative value of the standard light and of the gas burning under the specified conditions in the standard burner.

So far as the first point is concerned, the proposed adoption of the Harcourt 10-candle pentane standard meets with very general approval. With regard to the second (the point around which controversy has raged during recent years), the proposed adoption of the Carpenter "Metropolitan" argand No. 2, will also be generally accepted, as thereby the demands of each of the opposing parties in the controversy are largely met—namely, on the one hand, that the gas shall be burnt at the rate of 5 cubic feet per hour, and, on the other, that the relative quantities of gas and air passing into the burner shall be adjustable so as to allow the gas to develop its full illuminating power. With the universal adoption of this burner and of the method laid down for its use, the records of illuminating power made in different parts of the country and for different kinds of gas will at last become comparable, and the hopeless confusion now existing will be ended.

It is self-evident that, with regard to these two points, it is absolutely necessary that definite and detailed statutory instructions shall be laid down, as any deviation from these materially affects the result. In the third of the above-named essential points, however, matters are somewhat different. Here there is no question of properly developing the two lights, but simply of the measurement by physical means of their comparative value; and the only necessity is that the method adopted shall be such as gives the comparison with sufficient accuracy for practical purposes. There may be a large number of methods fulfilling this condition; and in deciding between methods of equal accuracy, the factor having the most weight will be the relative ease and rapidity with which they enable the tests to be carried out.

At the present time there are only two photometers requiring consideration—the table photometer and the open bar photometer; so that there are three courses which may be taken in drafting the testing clauses: (1) To specify the employment of the table photometer; (2) to specify the employment of the open bar photometer; and (3) to make no specification of the exact apparatus to be employed, but simply to state that the comparison of the two lights shall be carried out by a method giving substantially accurate results, leaving open the exact details of the apparatus to be used.

In the proposed clauses, the first course is taken, principally because this method has been prescribed for use in London by the Gas Referees; and it is this particular suggestion which is felt by many to be undesirable. The table photometer was expressly devised for the carrying out of illuminating power tests in cases where the gas is burnt at such a rate as to give a constant illumination; and under these circumstances the standard of light, the gas-burner, and the photoped are absolute fixtures, and only the rate of gas consumption is altered while making a test. The substitution of the method of burning the gas at a constant rate of 5 cubic feet per hour for that of constant illumination has, however, rendered it impossible to carry out the test with the table photometer as formerly arranged; and if this general form is still to be employed, arrangements have to be made so that the standard of light, the gas-burner, or the photoped must be moveable—the other alternative being the abandonment of the table photometer, and the return to the bar photometer, in which the standard of light and the gas-burner are fixed, but the disc (the equivalent of the photoped) is moveable. In making their Notification for 1906, the Gas Referees have retained the table photometer, but have introduced arrangements whereby the gas-burner is made moveable; and it is this modified instrument which the proposed clauses would make obligatory.

Now, while the table photometer in its old form was in many ways a very satisfactory apparatus, the modification now introduced, of making the gas-burner moveable, renders it largely a different instrument; and the present method of employing it can only be regarded as experimental, and will doubtless be subject to alteration if not found satisfactory. Under these circumstances, it seems most undesirable that this method should be specified as the generally applicable statutory means of determining illuminating power. My own personal experience with the table photometer as modified has led me to the opinion that, while with care accurate results can be secured, equal accuracy is obtained with much greater ease by means of the bar photometer. The point of equality of illumination on the photoped appears to me to be much less readily determined when the burner is moved backwards and forwards than it was under the former conditions, when equality of illumination was obtained by regulating the gas consumption; and in principle the movement of the burner in this manner is objectionable, and should, if possible, be avoided. With the bar photometer, on the other hand, where the burner is fixed and the disc moveable, the point of equality of illumination is more readily and quickly ascertained. Of course, it must be acknowledged that, in forming an opinion of the relative value of the two methods, the personal equation must come in to an appreciable extent; and there will doubtless be considerable divergence of opinion on the point among different operators.

But apart from this point, in most gas-works the photometer is employed for other purposes than the statutory determination of the illuminating power of the gas delivered to the consumer, and, in particular, is now used largely for the examination of incandescent burners. For the latter purpose the table photometer is quite unsuited; whereas the bar photometer, with easily added adjuncts, may readily be employed. While in the case of large undertakings, where very many tests of all kinds are constantly going on, it may often be necessary to have different photometers for the various purposes, this is not so with smaller works; and the provision of separate instruments for the various kinds of tests would in their case entail considerable and unnecessary expense. Doubtless one of the reasons which led the Gas Referees to modify the table photometer for use in the Metropolis, rather than abandon it and revert to the bar photometer, was the fact that the expense entailed upon the companies would be much less; but in the great majority of the gas undertakings in the country the bar photometer is at present provided, so that in their case the employment of that instrument would bring about the least expenditure.

It appears to me, therefore, that if the exact description of apparatus to be employed for the comparison of the standard light, and the gas burnt in the standard burner under the specified conditions is to be made statutory, the adoption of the open bar photometer is greatly to be preferred to that of the table photometer as modified in accordance with the recent instructions of the Gas Referees. I believe, however, that any exact prescription of the apparatus other than the standard of light and the gas-burner is undesirable, and that all that should be required is that the means adopted for the determination of the comparative value of the two lights should be such as gives substantial accuracy. It is by no means improbable that more suitable and convenient methods than either of those already discussed may be devised in future; and in that case the stipulation of the exact apparatus would preclude such improved method being adopted without an alteration of the law in this respect. As a somewhat similar case, the requirement of the Alkali Act of 1881 may be taken, according to which the gases escaping into the air from sulphuric acid chambers must not exceed 4 grains per cubic foot, in which case it is not found necessary to specify the exact nature of the chemical apparatus to be employed in determining the quantity present—any method capable of giving accurate results being permissible. So in the same way, with regard to the physical measurement of the comparative value of two sources of light, any physical apparatus which gives this with sufficient accuracy may be employed.

One other point requires noting. Any fresh clauses in regard to the statutory determination of illuminating power should remedy an omission in that part of the Gas-Works Clauses Act, 1871, dealing with this matter, in which no reference is made to the correction of the gas consumed for pressure and temperature. A clause should be inserted requiring the correction of the gas volume to 60° Fahr. and 30 inches of the barometer, in accordance with the usual practice.

THE OHIO QUESTION-BOX.

[Concluding Article.]

High-Pressure Gas Distribution—Gas-Engines.

The article last week ended with some references to the subject of electrolysis culled from the material appearing in the section dealing with distribution supplies and materials; but on turning over the pages of the succeeding section on "Distribution Operation," further allusions to the subject are discovered. With all deference, the information, in our opinion, would have been more useful if grouped. But we must not reopen the subject of electrolysis, as space can only be afforded for short mention of the subject of pressure, upon which several questions are found in the section under notice.

The point is discussed as to whether higher distribution pressures result in increased gas bills; and the general view is that they do. On the other hand, it is believed that the illuminating power realized from incandescent gas-burners is enhanced by the higher pressure, if there is proper adjustment of the burner. In view of the admission as to the ill-effects upon the consumers' bills, there seems to have been little occasion for the inquiry as

to whether it is advisable to instal a high-pressure system gas plant in a compactly-built town of 12,000 people. Those against the proposition are in the majority; but there are a minority who appear to be halting between two opinions, but feel called upon to cast a reply bearing somewhat slightly on one side. Hence we read, in one contribution, "provided the pressure is not too high, it will probably result in securing a much more satisfactory service;" and again it is written, "if a town has no plant, would recommend a high-pressure system. If a low-pressure system is in operation, make no change." There are only three contributors who definitely reply in the affirmative. It is, however, a volume of contradictions.

Immediately afterwards, it is found that, in reply to an altogether different inquiry, several correspondents assert the advantage of pressures of from 8 to 15 inches. Such pressures make the supply more satisfactory where pipes are small, provided there is proper control by suitable regulators at the meters. High pressures, says another contributor, make more satisfactory service at all points, and also reduce the cost of piping in proportion to the increased capacity of the pipes. The tendency to these higher pressures is regarded as a natural one, particularly at the time of maximum load; and the testimony is given by one correspondent that consumers rarely complain of excess pressure, while they are sure to grumble when there is a lack of it. Mr. Walton Forstall joins in this correspondence; and, assuming that the question and the pressures of 8 to 15 inches have reference to an ordinary low-pressure distribution system, he says he believes these pressures exist only because of original failure to lay mains large enough for the demand for gas. He considers it unwise to have any pressure over 4·5 inches in a main directly supplying consumers, furnished with ordinary appliances, unless a governor is installed in each house. In the case of high pressures, the experience with individual governors has, it is gathered from a succeeding question and answers, been that they give very little trouble; and, whether situated on the inlet or outlet pipe of the meter, does not appear to make any difference.

The boosting of pressures is also dealt with, and is well spoken of. One correspondent states that at Evansville, Ind., a 4-inch high-pressure line which belts part of the city has been laid, and is now in use. This line feeds into the low-pressure system at different points. With a distributing pressure of 36-10ths, a minimum pressure has been secured of 27-10ths in districts where the pressure was as low as 10-10ths and 12-10ths. Consumers are also supplied off the high-pressure line—a separate house governor regulating the pressure. A kindred matter is put forward in the question as to which, being troubled with a poor pressure due to small mains, is the cheaper and better remedy—to run a 10-inch pipe round the town as a feeder, or to lay a 2-inch pipe to various points where the pressure is weakest, using governors direct from the booster. The advice generally given is that the latter course is the preferable one, on account of cheapness, providing there is no prospect of good consumers coming on to the 10-inch main. Information as to the cost of compressing gas to 25 lbs. pressure is desired by a correspondent; and two answers are given which may be quoted. Says one writer: The cost of compressing gas—no extra men being needed, the moisture separated from the gas near the works, and an economical compressor used—should not exceed 2 c. per 1000 cubic feet. The other contributor writes: At a test-run made at Appleton, Wis., using screened Youghiogheny coal, with a compressor piped direct to a 35-horse-power return tubular boiler, and no steam used for any other purpose, in a 5½-hour run, 325 lbs. of coal were used for 35,000 cubic feet of gas pumped. Gas pressure at 4.30 p.m. was 12 lbs.; at 5 p.m. 14 lbs.; at 6 p.m. 14 lbs.; at 7 p.m. 16 lbs.; at 8 p.m. 17 lbs.; at 9 p.m. 19 lbs.; at 10 p.m. 24 lbs. The following night, using coke on a 5-hour run, and a constant pressure of 18 lbs., 327 lbs. of coke were used for 27,000 cubic feet of gas pumped. Whether there should be any leakage in 20 miles of high-pressure main, with gas at 25 lbs. pressure, is an inquiry which calls forth negative answers from correspondents. It is thought that, if the pipe-lines are put in properly, there should be no leakage. One contributor mentions that, in 16 miles of one branch of his system laid two years ago, with Dresser couplings, there is only one small leak on the line. In this case from 40 to 60 lbs. pressure is carried. Supporting evidence is given by another contributor.

Passing over the section referring to chemistry and physics other than manufacturing, we come to that referring to gas-engines; and incidentally, in looking through the questions, it is gathered that the reason the gas-engine is not more generally used in the States is that the price of gas is high. The same is the characteristic of the initial cost of engines; and their sellers are also charged with making such extravagant claims for them that the result has been to cause manufacturers to look upon gas-engines with suspicion. Later, too, it is learned that some engineers are of opinion that it would be a good thing to have licensed engineers for operating gas-engines. This would be a good way of putting a further restriction upon their use; but all the correspondents are not of opinion that experience has shown such a precaution to be necessary. Until it does, the less said about the matter the better.

In the gas-consuming appliance section, there is the strongest possible recognition that the best appliances, by the satisfaction they give to the consumer, are the ones that will inure to the greatest advantage of the gas industry, and therefore are the ones to be encouraged, while poor appliances should be with equal heartiness condemned. The remainder of the volume is occupied chiefly with the sections discussing dealings between gas suppliers and consumers.

But here we must part from the volume, with the remark that it is hoped the criticism on points will not be regarded by our friends on the other side as an intended condemnation of the whole. It is nothing of the kind. There has been an endeavour to show the usefulness of the new volume; and at the same time to disclose certain ways in which, in our opinion, that usefulness might be extended.

STILL GAS.

An article upon the analysis, composition, and properties of the gas which is obtained on distilling Thuringian brown coal appeared some short time ago in the German journal, "Braunkohle," from the pen of Dr. E. Graefe, of Webau; and from it we have extracted the following particulars.

On destructive distillation, brown coal yields four products—tar, coke, liquor, and gas. The material is always distilled under a slight vacuum; and therefore the gas invariably contains a certain proportion of air. It also contains, as natural ingredients, some of the higher homologues of the paraffin or methane series; so that the ordinary processes of gas analysis have to be somewhat modified if these hydrocarbons are not to be returned as methane simply. A sample of brown coal gas examined by the author gave on analysis 10·9 per cent. of carbon dioxide, 1·1 per cent. of unsaturated hydrocarbons, 6·3 per cent. of oxygen, 8·5 per cent. of carbon monoxide, 22·6 per cent. of hydrogen, 6·4 per cent. of methane, 2 per cent. of higher paraffins calculated as ethane, and 42·3 per cent. of nitrogen. Owing to the simultaneous presence of oxygen and sulphuretted hydrogen in many specimens of the gas, it is necessary to determine the amount of the latter as quickly as possible; for a mutual decomposition soon occurs between them—causing the water over which the gas is stored to become cloudy, from separation of sulphur. The sulphuretted hydrogen is best determined by titration with iodine; a measured volume of the gas being shaken up with a solution containing 1·134 grammes of iodine and 10 grammes of potassium iodide per litre, titrating back with a solution of about 2·22 grammes of sodium thiosulphate, previously compared with the iodine, in presence of starch. In another sample, the sulphuretted hydrogen and carbon dioxide are absorbed in caustic soda; the difference between the two results giving the carbon dioxide. After the sulphuretted hydrogen and the carbon dioxide have been removed, the vaporized hydrocarbons, if any, may be determined; but the sulphuretted hydrogen must be removed first, or the mercury will be discoloured.

As brown coal is a mixture of bituminous matter, water, ash, and products intermediate between cellulose and carbon, it is a matter of some interest to ascertain whence the various constituents of the gas are derived. A good sample of the brown coal, containing 32·5 per cent. of bituminous matter, was distilled in its original condition, after extraction with a solvent for the bitumen, and the extract itself was treated in the same fashion. The original sample gave 35 per cent. of coke, 23 per cent. of water, 33 per cent. of tar, and 9 per cent. of loss or gas; the extracted residue gave 48 per cent. of coke, 19 per cent. of water, 21 per cent. of tar, and 12 per cent. of loss; the extract gave 12 per cent. of coke, 5 per cent. of water, 78 per cent. of tar, and 5 per cent. of loss. On analyzing the gases, and recalculating the figures in order to eliminate the constituents of the air drawn in through leaks in the apparatus, the annexed results were obtained:—

	Original Material.	Extracted Residue.	Bituminous Material.
Vaporized hydrocarbons	1·7	0·9	—
Unsaturated hydrocarbons	13·6	7·8	13·9
Carbon dioxide	20·0	20·3	7·5
Carbon monoxide	13·0	13·6	26·6
Hydrogen	21·9	28·8	4·6
Methane	24·6	23·4	24·8
Ethane	6·4	5·5	19·7

Hence it appears that the carbon dioxide and the hydrogen come chiefly from the brown coal substance itself, while the carbon monoxide and the higher saturated hydrocarbons are derived principally from the bituminous matter. The higher paraffins, however, are not true products of the distillation, but arise from a secondary decomposition of the original products due to the hot walls of the still, in a similar fashion to that observed in the case of oil gas. Their formation can be avoided by distilling the brown coal under very low pressure; but, of course, their presence in the gas increases its calorific value. For example, the gas from the bituminous portion described above owes 37·8 per cent. of its heating value to the higher paraffins (assumed to be ethane), 29·5 per cent. to the methane itself, and 23·3 per cent. to the unsaturated hydrocarbons (assumed to be ethylene).

Too far reaching a decomposition of the bituminous matter during distillation can be avoided by lowering the pressure within the still, or by blowing steam into it. The steam acts mainly by hurrying the gases into the condenser; for they are already largely diluted with water vapour. As 1 hectolitre of brown coal, containing about 35 kilogrammes of water, yields about 10 cubic metres of gas and 5 kilogrammes of tar having

a mean molecular weight of 200, it may be calculated that the vaporized contents of the still consist of 18 per cent. of gas, 80 per cent. of steam, and 2 per cent. of tar vapour approximately. As Ramdohr has shown, it is possible to volatilize the bituminous matter almost unchanged out of the still if sufficient steam is employed; but that is not desired in practice, as a certain amount of decomposition is required, provided it stops short of the secondary or oil-gas stage.

The calorific value of the gas depends on the apparatus in which it is produced. The gas from an old leaky plant may yield only 37 large calories per cubic foot; that from a new plant, 102. It can be consumed under a mantle in a Welsbach burner with altered air inlets; but this employment is not common. More generally it is used in gas-engines—from 35 to 71 cubic feet (a quantity equivalent to about 2500 large calories) being required per horse-power-hour. Hundreds of horse-power are developed in this manner; the energy being often consumed in the generation of electric current. Objections are sometimes made to the explosion of the gas in engines on the ground that the sulphur must be prejudicial to the cylinders and valves; but it should be remembered that brown coal tar oils have been used for years in the same way, and they contain 1 or 2 per cent. of sulphur. Actually, if the gas contains less than 1 per cent. of sulphur, oxide purification is unnecessary; but naturally the maximum permissible proportion of sulphur must be considered in relation to the calorific value of the gas. Frequently the gas is employed to replace part of the fuel otherwise consumed in heating the brown coal retorts. Without the assistance of gas, the consumption of fuel is, roughly, 1 part by measure per 2 parts of brown coal; but when gas is burnt as well, the consumption of solid fuel may fall to 1 part per 5 or 6 parts by measure of brown coal. For this purpose, the gas is drawn from the condensers with a fan or with a steam-driven exhauster. The latter plan appears faulty, inasmuch as it involves a loss of heat; in practice, however, it has the advantage of causing the gas to travel at a high speed within the injector, and so of minimizing the danger of an explosion proceeding backwards to the stills. All danger can, of course, be removed by inserting a non-return or explosion valve between the condenser and the injector.

A patent has been taken out for decomposing the sodium carbolate (phenolate) recovered in working up the brown coal tar with the aid of the sulphuretted hydrogen in the gas; sodium sulphydrate being produced, which reacts with some loosely combined sulphur to give a fresh quantity of sulphuretted hydrogen. The process, however, does not appear to be employed on a large scale. Another plan is to wash the gas with monohydrated sodium carbonate, which reacts with the carbon dioxide to form sodium bicarbonate; and then to use the bicarbonate to decompose the sodium phenolate. The sodium carbonate which is reproduced is evaporated and dried, so as to yield a fresh quantity of the monohydrated salt. The hexahydrated carbonate (ordinary washing soda) and the anhydrous carbonate do not combine efficiently with the carbon dioxide of the gas. Attempts have also been made by Krey to convert the carbon monoxide into formic acid, by leading the gas over moist caustic potash heated to 200° C. First of all, the gas must be freed from carbon dioxide and sulphuretted hydrogen.

Dr. Graefe devotes the final portion of his article to a discussion of methods for recovering the hydrocarbons that are carried with the brown coal gas in a state of vapour. Theoretical considerations and actual experiments seem to show that no practical gain is to be achieved by substituting water condensation for the air cooling which generally prevails on brown coal distillation works—that is to say, no increased amount of tar is to be recovered in this way. Nevertheless, the air-cooling plant occupies much space, and absorbs much capital; so that water-cooled condensers may be cheaper. A large quantity of water would be needed for the purpose, because the water vapour in the gas coming from the natural moisture of the coal and from the steam injectors has to be condensed; but inasmuch as the factories are usually located at the mines, the water which has to be pumped out of the workings may often suffice for all the needs of the condensing arrangements.

POSITION OF THE ITALIAN GAS INDUSTRY.

Suggested Training School for Chemists.

Among the communications that were to be submitted to the Sixth International Chemical Congress held in Rome last week, was one by Captain Vittorio Calzavara, of Venice, who strongly urges the necessity of instituting a training school for the use of students from the Universities, &c., who might be desirous to specialize as gas or chemical engineers. Attention is drawn to the facilities for the education of gas chemists which exist in other countries—particularly to the "Gas Manufacture" examinations of the City and Guilds of London Institute, the works erected at Carlsruhe (with the assistance of Dr. Bunte) for the manufacture and analysis of gas, the analysis of coal, photometrical experiments, and trials of all new machinery that may be invented for the benefit of the gas industry, and the gas technical schools at Dessau and Bremen. Before, however, explaining his own idea of what should be done in this direction, the author gives an interesting sketch of the present position of the gas industry in Italy, which we will glance at briefly.

While admitting that the growth of gas consumption in Italy is satisfactory enough in a way, Captain Calzavara points out that the percentages of increase do not in any way reach what is to be seen abroad. In Berlin, in the year 1860, the consumption of gas was 14 million cubic metres; in 1880, it was 62 million cubic metres; and in 1900, it rose to 161 million cubic metres. Thus in the twenty years from 1880 to 1900 the increase was about 100 million cubic metres; while in the preceding twenty years it was only 48 million cubic metres. Taking Paris, in the year 1880, 244 million cubic metres of gas was consumed; while in 1900 the figure had risen to 350 millions—or an increase of 106 millions. The consumption in Rome in the year 1895 was about 14 million cubic metres, and in 1904 20 millions; while taking the whole of Italy, the production in 1896 was 164 million cubic metres, and in 1904 245 millions—showing an augmentation in ten years of 81 million cubic metres. The figures quoted prove that gas is not in process of succumbing to the competition of electricity; but Captain Calzavara concerns himself mainly with a consideration of the causes to which the comparative delay in the development of the industry in Italy is attributable.

In the first place, he says, the greater number of the gas-works in Italy—or at least those of the great towns—were erected during the years approaching the middle of last century, when the production of gas was carried out almost as Murdoch had imagined it in his Soho Works in 1803; and the contracts which were concluded between the various gas companies and their respective municipalities, give rise to the query, What interest could the former have in introducing improvements that were made elsewhere? It was sufficient for them to confine themselves to the agreed terms; and they considered perhaps that improving their works was a waste of money. In ten, or at most twenty, years, however, many (if not all) the gas-works in Italy will end their contracts; and then the works will become the property of the municipalities. Moreover, there is the law of 1903 (which was referred to at length in the "Journal" at the beginning of that year) to bring about the acquisition of "public services" by local authorities who may have ambitions in that direction. By the way, it is interesting—in view of what we said about the matter at the time—to note Captain Calzavara's hope that, by reason of the many different interpretations that have been put upon this law, it "will be soon radically reformed."

The next consideration is the *personnel* of those who will undertake the management of the gas-works when they have been purchased or have, in the ordinary way, through the expiration of the concessions, passed into the hands of the municipalities. It is stipulated that the persons who will compose the "Commission of Administration" must be selected from among those who have a technical knowledge of gas. The policy adopted by the foreign companies who have had a monopoly of the gas industry in Italy has, says Captain Calzavara, hitherto rendered it impossible to have a technical Italian staff; but present circumstances make it necessary to consider the formation of such a body. He draws attention to the great need of chemists in connection with the gas industry, not only in relation to the bye-products, but so that gas may retain its position for lighting, power, and heating purposes. He thinks also that when the public know that the gas-works administrators are qualified Italian chemists, they will have much more confidence in the industry.

Captain Calzavara is of opinion that some such scheme as has been successfully carried out in Germany can be inaugurated in Italy, without asking very much of the Government beyond their consent and moral support; the estimated cost of a school similar to that at Carlsruhe being 120,000 lire. If this sum were subscribed, it would be sufficient on the part of the Government to pay a Professor of Chemistry, who would control the school. If the 200 gas-works in the country agreed to find the money for the building of the school, and the contributions were reckoned on the make of gas—244,832,974 cubic metres in 1904—it would be necessary for each works to hand over a 2000th part of a lira for each cubic metre of gas made. Reckoning the maintenance of the school to cost 10,000 lire per annum, the yearly contribution, if all the works joined, would not need to be more than a 10,000th part of a lira per cubic metre of the output. There would be a Council of Administration elected from the Directors of those works which agreed to join the scheme. Captain Calzavara feels confident that, with the spirit which now exists in gas-works, including those worked with foreign capital, the necessary assent to the proposal will be obtained; and he makes kindly allusion to the strong feeling of union that binds the foreign gas administrators to Italy, which, he says, "is considered by them as a new native land."

The paper concludes with an account of all the good work that such an institute may be able to perform, and some details of the present backwardness of Italy in the matter of the working up of the bye-products of gas manufacture.

Manchester and District Junior Gas Association.—The members of the Association will pay a visit next Saturday to the Bolton Corporation Gas-Works on the invitation of Mr. W. Smith, the Engineer and Manager; and on the 26th inst., the annual joint visit with the Yorkshire Junior Gas Association will take place, when the party will inspect the New Wortley Gas-Works of the Leeds Corporation.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Newcastle.

The Members of the North of England Gas Managers' Association held their Fifty-Eighth Half-Yearly Meeting in the County Hotel, Newcastle-on-Tyne, on Saturday last. Mr. MATTHEW LEAF, of York, the President, occupied the chair. There was a good attendance.

The HON. SECRETARY (Mr. Herbert Lees, of Hexham) read a letter from Sir Samuel Sadler, of Middlesbrough, dated Oct. 11, 1905, acknowledging the resolution which was passed at the last autumn meeting of the Association, and thanking the members for their warm congratulations on the knighthood that had been conferred on him.

ANNUAL ACCOUNTS.

The PRESIDENT submitted the annual accounts, which, he said, had been duly audited. He remarked that when they noted that they commenced the year with a balance of £35 8s. 2d., and finished it with a balance of £61 9s. 8d., they might regard the operations for the twelve months as highly satisfactory. He proposed that the accounts be adopted and passed in the form in which they had been sent out.

Mr. H. WILKINSON (Harrogate) seconded the motion, remarking that the financial results were extremely satisfactory.

The motion was adopted.

NEW MEMBERS.

The following were admitted to the Association: Mr. Joseph H. R. Head, Gas Engineer to the North-Eastern Railway Company, as a member; and Mr. Wm. Bell, Newcastle, pupil to Mr. W. Doig Gibb, Mr. John W. Halstead, junior draughtsman, North Shields Gas-Works, and Mr. John R. Boadle, assistant, Borough of Workington Gas Department, as associates.

PAPERS READ AND DISCUSSED.

The reading of the two papers prepared for the consideration of the members was then proceeded with. The papers and a report of the discussions that resulted will be found on pp. 304 and 309 of to-day's issue.

VOTES OF THANKS TO AUTHORS OF PAPERS.

Mr. T. BOWER (West Hartlepool) said it was with very great pleasure that he rose to propose that the best thanks of the Association be tendered to the authors of the papers which had been placed before the members, which he thought everyone would agree had been of a highly practical and educational character. With reference to the first, there were so many engineering features which could be brought into the construction of a gasholder that it was largely a question of what experience the members might have had, though there was always something to learn and to be improved upon; and the paper by Mr. Nelson was one which he felt would probably prevent gas engineers in future having many pitfalls which they might have had if they had not the opportunity of referring to such a paper as the one under notice. The other paper was also very instructive; and he had no doubt that when they came to read it at home they would feel they were more than ever indebted to its author.

Mr. J. H. PENNEY (South Shields) seconded the motion, and it was agreed to.

Mr. FOREMAN acknowledged the vote, and expressed the hope that he might be able to give the members another paper on a future occasion.

REPRESENTATIVE ON THE COUNCIL OF THE INSTITUTION.

The HON. SECRETARY intimated that the Council of the Association had selected Mr. Leaf, their President, to represent them on the Council of the Institution of Gas Engineers.

ELECTION OF OFFICE-BEARERS.

As the result of the ballot, the following were elected office-bearers for the year:—

President.—Mr. T. Hardie, of Gateshead.
Vice-President.—Mr. H. Wilkinson, of Harrogate.
Auditor.—Mr. C. H. Armstrong, of Wallsend-on-Tyne.
Hon. Secretary and Treasurer.—Mr. Herbert Lees, of Hexham.
Members of Committee.—Mr. C. Dru Drury, of Sunderland; and Mr. A. C. Hovey, of Tynemouth.

CONCLUDING BUSINESS.

Mr. J. WHYTE (Seaham Harbour) proposed a vote of thanks to the Committee, for the manner in which they had managed the affairs of the Association during the year.

Mr. J. HOLLIDAY (Hull) seconded the proposition, and it was carried.

Mr. J. H. COX (Sunderland) proposed a vote of thanks to the President for his able conduct of their business.

Mr. D. TERRACE (Middlesbrough) seconded, and the motion was cordially agreed to.

The PRESIDENT, in acknowledging the vote, said that so long as the Association had a Secretary like their friend Mr. Lees at the elbow of the President, the latter would not find his duties very irksome.

Mr. WILKINSON returned thanks for the honour conferred upon him, in his election to the office of Vice-President, which, he said, he had only accepted on pressure.

The HON. SECRETARY asked that, in the absence of the President-elect, the selection of the next place of meeting be left to the Council, though he quite expected it would be Newcastle.

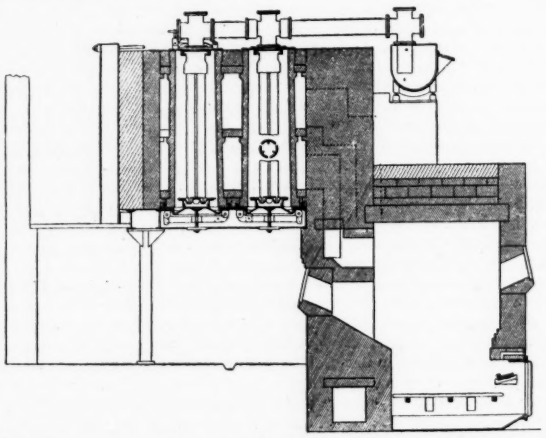
This having been agreed to, the proceedings terminated.

Thereafter the members and friends, to the number of about seventy, dined together in the hotel—Mr. Leaf in the chair. The toast of "The North of England Gas Managers' Association" was proposed by Mr. Charles Wood, the President of the Institution of Gas Engineers, and acknowledged by the President in a speech full of humorous reminiscence. Mr. C. Dru Drury proposed "Kindred Associations," and the toast was acknowledged by Mr. H. O'Connor, of Edinburgh.

THE PARKER VERTICAL RETORT.

The last issue to hand of the "American Gaslight Journal" contains a description of the above-named retort, which has been designed primarily for use where the non-continuous system is employed, though it is susceptible of modification so as to be capable of application in the continuous process. The arrangement is shown in the accompanying illustration, which has been prepared from a plan of a bench of six retorts.

The principal object of the device is to provide a central tube for taking off the gas generated in vertical retorts; the tube to be of such form as to make the collection of the gas and the discharging of the coke practicable. The idea of using the vertical form of retort with a central tube is not a new one; but some of the advantages arising from its use may be pointed out. The first of these is the providing of an escape for the gas, so that it will not remain in contact with the heated surface of the retort.



This will mean an increase in the yield, and a higher candle power, as part, or possibly all, of the hydrocarbons, which ordinarily are broken down by overheating, and are deposited on the surface of the retorts in the form of carbon, will be preserved as illuminants. Another advantage arising from the use of the central collecting-tube is a reduction in the time required to carbonize a charge of coal. The heat, as applied to vertical retorts, must penetrate a gradually deeper layer of material as it works towards the centre of the charge. If this central core of coal in the retort can be done away with, the remaining portion can be burned off in a much shorter time, and the entire mass will be more equally carbonized.

The retorts, as laid out in the present design, measure 7 feet high over all, with a top and bottom diameter of 1 ft. 9 in., and 1 ft. 11 in., respectively. The central tubes are of cast iron (having interior stiffening ribs) 10 inches in diameter outside, and made in three longitudinal sections. These sections are centred independently at the bottom, so as to leave space between for the gas to enter. They are hung from short collars at the top, the collars being secured in such a way as to be horizontally slidable, in order to be easily disengaged from the top mouthpieces when it becomes necessary to remove the collecting-tubes for the purpose of cleaning or repairing. The dimensions named will give the mass of coal to be carbonized a thickness of 6½ inches at bottom and 5½ inches at top of the retorts.

The combustion chamber is divided horizontally by tiles into two parts. The secondary air, which is preheated in the usual manner, is fed into the lower half of the combustion chamber in such a way as to give a very long flame; thus deferring part of the combustion of the furnace gases until they reach the upper

combustion chamber. Before charging the retorts, the coal will have to be put through a crusher, so one may reckon 51 lbs. of coal per cubic foot of retort capacity, or a charge of 600 lbs. per retort. Whether or not this charge can be carbonized in four hours is a matter of conjecture. The retorts would be charged and discharged in pairs, as there would only be one dip-pipe for each two retorts.

CYANOGEN SLUDGE.

An article upon the above subject was written some months ago in the "Zeitschrift für angewandte Chemie" by Dr. Adolf Hand, of Niederschöneweide. The writer is engaged at a chemical factory where, for the past seven years or more, cyanogen sludge from many different gas-works of the Continent has been worked up. In the light of experience so gained, Dr. Hand discusses the average composition and chemical constitution of the material in question, and gives a scheme for the determination of the more important bodies contained in it. The substance Dr. Hand has in mind throughout his article is the cyanogen sludge which is obtained when the cyanogen compounds of crude coal gas are recovered in a manner consonant with the spirit of Dr. Bueb's German patent No. 112,459.

Writing about three years ago, Herr Feld stated that from one-third to one-half of ordinary cyanogen sludge is composed of soluble ammonium ferrocyanide (Am_4FeCy_6), from one-quarter to one-third being insoluble ferrous cyanide (Fe_2FeCy_6), and from one-third to one-quarter being insoluble ferrous ammonium ferrocyanide ($Am_2FeFeCy_6$). He also found that the ratio between the amount of insoluble cyanogen compounds contained in it, expressed as Prussian blue according to the formula Fe_7Cy_{18}, and the amount of insoluble ammonia, varied largely; ranging, per 100 parts of the former, from 6·30 to 11·84. Herr Feld likewise gave a method for analyzing the material, which is not acceptable in all points to Dr. Hand.

In the present contribution, Dr. Hand places on record a large number of analyses of cyanogen sludge; the samples dating from the early days of 1898, when the gas-washing liquor was prepared from waste ferrous chloride, up to and after the time when the use of that reagent was abandoned in favour of ferrous sulphate. The figures indicate the total proportion of cyanogen compounds present, the proportion soluble, and the proportion insoluble in water (calculated as insoluble blue in all cases); the total, soluble, and insoluble proportions of ammonia; and the ratio between the insoluble cyanogen and the insoluble ammonia. The results show that the quantity of total cyanogen, returned as ferric ferrocyanide, generally varies between 8 and 15 per cent., but tends to be higher in the winter months, when the gas-works washers are more heavily driven. In all instances, however, the ratio between the insoluble cyanogen and the insoluble ammonia is sensibly constant at 100:18; the actual figures for the insoluble ammonia, calculated per 100 parts of insoluble cyanogen, only varying from 16·8 to 18·6. The amount of soluble cyanogen compounds in the sludge, calculated as Fe_7Cy_{18}, has varied from 0·0 to 6·7; the average being 3·6 per cent. According to Feld, they vary from 4·11 to 8·65; his mean being 6·7 per cent.

If a cyanogen washer is not allowed to become too cold, the presence of a large quantity of soluble ammonium ferrocyanide in the sludge is due to the fact that the material has not been replaced by fresh at the proper time. It is easy to show by experiments that the insoluble compound of iron, cyanogen, and ammonium, which will be described immediately, may be gradually decomposed into ammonium ferrocyanide if it is brought into contact with excess of ammonium cyanide—*i.e.*, with excess of crude gas. In practice, provided the concentration of the ferrous sulphate liquor is that prescribed in Bueb's patent, the decomposition mentioned does not occur, because it would be accompanied by an increase in the viscosity of the sludge, which would oppose too great a resistance to the passage of the gas through the washer. If, on the other hand, less concentrated ferrous sulphate solution is employed, as recommended by Feld, the result is to imitate the conditions of the old Rowland process; weak liquors, costly to transport to the chemical works, loaded with soluble ammonium ferrocyanide and ammonium sulphate being obtained, which must either have the cyanogen compounds in them precipitated, or must be submitted to the expensive and troublesome operation of evaporation after being so treated with lime as to produce dilute solutions of calcium sulphate.

According to Feld, the substance characterizing cyanogen sludge is an insoluble ferrous ammonium ferrocyanide having the composition $Am_2FeFeCy_6$. He suggests that this body is formed by the action of hydrocyanic acid and ammonia upon free ferrocyanogen, $FeCy_2$. His explanation will not serve, firstly because all experiments hitherto carried out have failed to show that ferrocyanogen has a separate existence, and, secondly, because the composition of Feld's compound does not agree with the constant ratio existing between the insoluble cyanogen compounds and the insoluble ammonia as found by Hand's analyses to occur in normal sludge. The ratio in question—viz., 100 parts of Fe_7Cy_{18} to 18 of NH_3—shows that the characteristic constituent of cyanogen sludge has the composition $2AmCy{\cdot}FeCy_2$; and, though complete proof is still lacking, the substance appears to be a compound of one molecule of ferrous cyanide with two molecules of ammonium cyanide, rather than an equimolecular compound of ammonium ferrocyanide and the insoluble double salt $Am_2FeFeCy_6$. When solutions of hydrocyanic acid, ferrous sulphate, and ammonia are mixed together under proper conditions, a yellowish-red precipitate is obtained, manifestly identical with the characteristic orange amorphous body present in the sludge, which, on being analyzed after standing for a day, gives 18·2 parts of insoluble ammonia per 100 parts of cyanogen calculated as Fe_7Cy_{18}. When $2AmCy{\cdot}FeCy_2$ is shaken with much water, and more particularly when it is boiled, it is converted into the white compound $Am_2Fe_2Cy_6$; ammonium cyanide being produced unless a sufficient quantity of ferrous hydroxide (ferrous hydrate) or ferrous sulphide is present. The insoluble cyanogen compound of ordinary sludge behaves in the same fashion if boiled for some time, or if allowed to remain in contact with a dilute mineral acid. For instance, one sample showing an original ratio of 100:17·8 gave a ratio of 100:11·47 after being boiled for three-quarters of an hour, and a ratio of 100:12·1 after being treated for 15 minutes with dilute sulphuric acid. The compound $Am_3Fe_3Cy_6$ should exhibit a ratio of 100:11·9. Some actual specimens of cyanogen sludge which had been either boiled with water or treated with sulphuric acid, then run through filter presses and partially washed, gave the present author ratios between the insoluble cyanogen calculated as Fe_7Cy_{18} and the insoluble ammonia of 100:11·1-12·6. Feld presumably found a low ratio for the ammonia because his sludges had been altered from their original composition by being largely diluted, and by being treated with magnesium chloride in presence of too much water during his analytical investigations.

Dr. Feld sums up this portion of his article in the following manner: When the cyanogen is extracted from coal gas by the Bueb process, a sludge is obtained principally consisting of an insoluble compound $2AmCy{\cdot}FeCy_2$, which has not hitherto been described; while a moderate quantity of soluble ammonium ferrocyanide is present as well. Where the proprietors of gas-works are interested in the manufacture of ammonia, there is no reason why they should not boil the sludge or acidify and filter it, as the operations are simple, and lead to a recovery of about three-quarters of the ammonia in the sludge. The plan of extracting the cyanogen of crude coal gas in the form of soluble ammonium ferrocyanide mixed with a large amount of dissolved ammonium salts lends itself much less readily to the subsequent working up of the cyanogen compounds than does the method of producing an insoluble compound of ammonium, iron, and cyanogen, as contemplated in Bueb's patent.

Analysis of Cyanogen Sludge.

Determination of Total Cyanogen.—Fifty grammes of well-mixed sludge are gently boiled with 100 cc. of caustic potash (30° Beaumé) and 200 cc. of water till the ammonia is driven off; the residue is then cooled to 15° C. and diluted in a measuring flask to 1010 cc. (This additional 10 cc. over the litre is a correction, established by numerous experiments, for the solid matter.) The liquid is filtered through a dry paper, and 25 cc. of the filtrate are diluted with 50 cc. of water and acidified with 10 cc. of 10 per cent. sulphuric acid. It is next titrated with standard zinc solution, prepared as under, until a drop of the liquid no longer strikes a blue with a drop of 1 per cent. ferric chloride on a piece of Schleicher und Schüll's paper No. 601. The zinc solution is prepared by dissolving 10·2 grammes of pure zinc sulphate (+7 Aq.) in water containing 10 cc. of strong sulphuric acid and diluting to 1 litre; its strength being set by titration against a solution of potassium ferrocyanide. The ferrocyanide is made up freshly when required by dissolving exactly 10 grammes of pure recrystallized K_4FeCy_6 + 3Aq. in 1 litre of water; 25 cc. of the solution being mixed with 50 cc. of water and 10 cc. of the 10 per cent. sulphuric acid before running in the zinc. The process is not absolutely correct, because the sulphuretted hydrogen or ammonium sulphide in the sludge converts a corresponding quantity of ferrocyanogen on boiling into sulphocyanogen; but experiments have proved that the error is so small that no more cyanogen than is equivalent to 0·1 or 0·2 per cent. of Fe_7Cy_{18} is lost by the reaction.

Determination of Total Ammonia.—Five grammes of sludge are distilled for an hour with 150 cc. of water and 3 grammes of solid caustic soda (or an equivalent volume of solution). The vapours are received in 50 cc. of seminormal acid, and titrated in the usual manner.

Determination of Soluble Ferrocyanogen.—Fifty grammes of sludge are diluted to 260 cc. (*i.e.*, 250 + 10, as above) and filtered through a dry paper. Then 10 or 20 cc. of the filtrate are acidified and titrated with zinc, as already described.

Determination of Soluble Ammonia.—50 grammes of sludge are filtered as in the last case, and 25 cc. of the filtrate are distilled with 150 cc. of water and 3 grammes of solid caustic soda into 50 cc. of seminormal sulphuric acid.

Determination of Free Ammonia.—25 cc. of the same filtrate as before are largely diluted with water and titrated with seminormal acid in presence of methyl orange as indicator.

The process which Feld has described for the estimation of the total ferrocyanogen gives very accurate results when applied to substances that can be accurately weighed; but in the case of cyanogen sludge, 2 grammes is too small a quantity to be weighed out. Hand's plan is preferable, especially on gas-works where analyses are often carried out by untrained laboratory assistants.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

Meeting at Grantham.

The Thirty-Fifth General Meeting of the Association was held at Grantham last Wednesday. A considerable number of members assembled round the President, Mr. R. G. SHADBOLT, the Engineer of the Gas Company serving the ancient town. The Angel Hotel was the *rendezvous;* and there the Chairman (Mr. John G. Thompson, J.P.) and Directors of the Gas Company received the members and entertained them at luncheon with the generosity that speaks of hearty welcome and a desire to aid their chief responsible officer in making the visit one of pleasant memories.

A WELCOME.

Mr. Thompson presided at this opening function; and had on his right the President, and on his left the Town Clerk (Mr. Aubrey H. Malin). At the close of the luncheon,

The CHAIRMAN said he must, as Chairman of the Company, give the members a most hearty welcome. They were extremely pleased to have such an important Association in their midst, and to see the members under the head of such an excellent President as their Manager. If he managed the Association's affairs as well as he did the Company's works, they would that day have a very successful meeting. Mr. Shadbolt did everything in the most thorough way; and he would see that the members had nothing to regret in having visited Grantham.

The VICE-PRESIDENT (Mr. E. J. Brockway, of Cleethorpes) said it was his pleasant duty to ask the members to accord to the Chairman and Directors of the Company their hearty thanks for the courteous and generous reception they had accorded the Association that day. He was sure he was voicing the feelings of every gentleman present when he said they most heartily and highly appreciated the kindness of their hosts.

Mr. J. CARTER (Lincoln), in seconding, said he was tempted to say that gas engineers were not conscious of any greater number of defects than fell to the lot of the average man; and he was quite certain they could never be charged with any lack of appreciation of hospitality that had been offered in such a kindly and ample style as that which had been offered them at Grantham. The remarks of the Chairman with reference to their President would find a very cordial response in the hearts of every one of those present. The members had given sufficient evidence of their regard for the capacity as well as the personal qualities of Mr. Shadbolt by putting him in the highest position in which they could place any member. He was their President, and to them all the kindly speech of the Chairman was a matter for the greatest possible gratification.

The proposition was heartily endorsed; and the Chairman responded.

The PRESIDENT explained that his Worship the Mayor would not be able to meet the members until later in the day; but they were honoured by the presence of the Town Clerk. He asked them to drink to the health of Mr. Malin.

There was a cordial response.

The TOWN CLERK, having expressed his pleasure at being present, said he had many times come in contact with Mr. Shadbolt, and always found him very courteous in his dealings. At one time there used to be a lot of friction between the Gas Company and the Town Council; but since Mr. Shadbolt had been the Manager, he did not think they had had a wry word. If they had wanted anything done, they had only to mention it to Mr. Shadbolt; and he had met them in the most cordial and free-hearted way. Before, they could never do anything—at any rate, until the electric light came into force. (Laughter.) He thought this was a change for the better; for it made the Gas Company "buck up." To see this, they had only to go round the town, and observe the manner in which it was illuminated. They might go into many towns round England, and would not find one equal to Grantham in its lighting arrangements.

THE BUSINESS MEETING.

The Meeting for the transaction of the business was held in the Sessions Hall, Guildhall—the PRESIDENT in the chair.

The minutes of the last meeting, read by the HON. SECRETARY (Mr. T. A. Guyatt, of Ely), were confirmed, on the motion of Mr. H. WIMHURST (Sleaford), seconded by Mr. C. F. RUGGLES (Leighton Buzzard).

ANNUAL REPORT AND ACCOUNTS—COMMERCIAL SECTIONS.

Moved by Mr. J. CARTER (Lincoln), and seconded by Mr. J. W. AUCHTERLONIE (Cambridge), the Committee's report and the accounts were adopted. The former opened with a general review of the proceedings of the year, and concluded as follows: The year commenced with a membership of 94. One member resigned, and two severed their connection under Rule 19. Five new members were elected; making a total membership at the end of the year of 96. The accounts for the year show that a balance of £53 16s. 1d. was brought forward, and subscriptions paid during the year amounted to £48 6s.—making a total of £102 2s. 1d. The expenditure was £66 14s. 5d., which leaves a balance in hand of £35 7s. 8d., and a few subscriptions outstanding. The Committee held several special meetings during the year in connection with the formation of Commercial Sections, as suggested in Mr. Shadbolt's paper read at the spring meeting, and agreed to at the autumn meeting. Two sections have now been inaugurated, and have commenced holding regular meetings. The Committee desire to acknowledge the cordial assistance that has been given the Association in this matter by Mr. Meunier and Mr. Brearley, who attended one of the special meetings, and gave detailed information on the working of the similar sections of the Manchester District Institution of Gas Engineers.

NEW ASSOCIATE-MEMBER.

Moved by Mr. H. WIMHURST (Sleaford), and seconded by Mr. G. R CASTERTON (Melton Mowbray), Mr. W. D. Helps, of Leeds, was unanimously elected an associate-member.

THE MAYORAL WELCOME.

On the arrival of the Mayor (Mr. Theodore Norton),

The PRESIDENT asked to be allowed to interpose to introduce his Worship to the members.

His WORSHIP, who was heartily greeted, said that, though he was late, his welcome was none the less sincere. They were indeed pleased to welcome the members of the Association to their ancient borough; and he hoped, apart altogether from the business, that they would have a really enjoyable time. He must congratulate the members on the gentleman who now occupied the responsible position of President. He could assure them that in Grantham they knew Mr. Shadbolt's capabilities very well. He was a man who had improved the gas supply and the lighting of the borough; and outside his work, they had a great liking and a great respect for him. He also congratulated the members upon the continued success of their Association. He (the Mayor) was not a gas manager, nor was he able to enter into any technical discussion of the merits of their operations; but he was satisfied, from the information given him by the President, that the organization was doing excellent work. Very heartily he welcomed the members in the name of the borough of Grantham, and hoped that they would soon revisit the town.

The PRESIDENT said it afforded him exceeding pleasure to acknowledge the kind welcome which the Mayor had given the members. He felt that their proceedings would not be complete if they did not have somewhat of a civic welcome by his Worship, although the Gas Company was not a department of the Municipality. He heartily thanked the Mayor, in the name of the Association, for his gracious words.

Mr. J. W. AUCHTERLONIE (Cambridge) then read the following paper:—

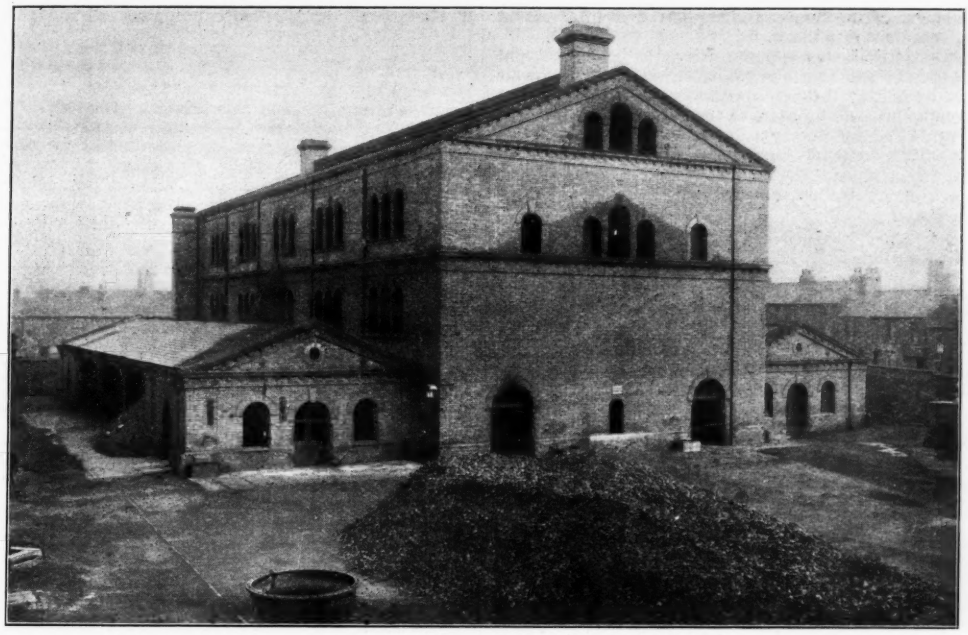
A FEW NOTES ON HORIZONTAL RETORTS CHARGED AND DISCHARGED BY DE BROUWER MACHINES v. INCLINED RETORTS AT CAMBRIDGE.

At the present moment when so much is being heard of the vertical retort, it may appear to some of our members that the subject of this paper is antiquated and out of date. To those of you, however, who are meditating any remodelling or extension of carbonizing plant, the question as to the best system to adopt is one that gives a considerable amount of thought; and any testimony as to the merits of the various methods in retort-house practice at present in vogue is worthy of consideration, and this paper will have fulfilled its mission if it produces a free discussion on the subject.

I am sure we are all glad to learn that a number of installations of vertical retorts are being laid down on the Continent; and it will be to the interest of the profession at large if an advance is made on our present methods. It will, however, take some years to prove the results obtained with vertical retorts; and at the present time, with the data to hand, there are few engineers, however progressive their inclinations, who would care to lay down an installation of vertical retorts of any great magnitude. In most cases, our choice of appliances is limited by the circumstances we find ourselves placed in. Usually the amount of money available governs the scheme; and fortunate is the engineer who can renew his plant without adding to the capital expenditure, interest on which is a veritable "Old Man of the Sea" to many undertakings.

In 1904, the writer was called upon to modernize a retort-bench in one of the retort-houses at Cambridge; and your Committee have considered that a brief description of the installation adopted would be of sufficient importance to bring before you to-day, more especially as we have an exactly similar house equipped with inclined retorts. A short description of the installation appeared in the "JOURNAL OF GAS LIGHTING" for Feb. 13 last (p. 421);* but I will give a brief *résumé* of what has already been written, with a few additional comments.

* The photographs and plans that appeared in the number of the "JOURNAL" referred to were used to illustrate the paper.—ED. J.G.L.



The Cambridge Retort-House—Showing the Amount the Roof was Raised for the Inclined Retorts.

HORIZONTAL SETTINGS.

The house last altered is a substantial brick structure 123 ft. 6 in. long by 52 ft. wide inside, and previous to the alterations was 27 ft. high to the eaves. It was of the ground-floor type, with direct-fired settings; and to obtain a stage-floor house with overhead coal-handling plant, it was necessary to raise the walls and roof by 15 feet. This part of the work was carried out by a local firm. Eighteen screw-jacks were placed under the shoes of the eighteen principals; each side of the roof being alternately raised 12 inches, and the walls built up. The scaffolding or platform inside the building was swung by means of hooks from the tie-rods of the principals and raised with the roof. The outside scaffolding was built up in the usual manner. A chimney, 80 ft. high by 11 ft. square at the base, stood in the centre of the old 18 feet wide bench; and although in good condition, it occupied so much valuable space that it was demolished with the old bench.

On the existing foundations, a retort-bench was built, 116 ft. long by 20 ft. wide, containing ten beds of through settings of eights, on the regenerative principle, with dwarf chimneys at either end of the bench. To enable me to get in retorts 20 feet long, and to have sufficient space for machines, the bench was placed out of centre; 17 feet being allowed on the machine side of the bench, and only 15 feet on the coke-discharging side. The retorts are of the Shoubridge section, and are tapered from 21 in. by 15 in. on the charging side to 24 in. by 15 in. on the discharging side. They are well supported throughout their length; thirteen walls (eleven of 7-inch and two of 9-inch brickwork) being introduced to minimize the sagging which usually takes place after retorts have been in action for some time.

The reason for adopting tapered retorts was that I considered it would facilitate the discharge of the coke by the ram. They have proved satisfactory, and I have had practically no trouble with coke jamming in the retort. Carbon does not accumulate on the charging end of the retort, and only slowly on the discharging side. In exactly three months the carbon at its thickest part, which is usually near the discharging end, only measured about 1 inch in thickness, tapering to nothing towards the centre of the retort. The taper on the retort allows for this slight accumulation of carbon, and no difficulty is experienced in the discharge of the coke. Some of the retorts have now been in use for 400 days, and have been let down once. The producers are on the discharging side of the bench. The gas is taken off on this side by means of a 7-inch diameter ascension pipe for each retort; the mouthpiece on the charging side being only 6 inches deep.

FIG. 1.

FIG. 2.

The hydraulic main is divided into ten sections; each section having a 10-inch diameter gas-outlet, and a 4-inch tar-outlet on the underside. Two 6-inch diameter tar-mains connected to tar-towers (one at each end of bench), take the tar from the hydraulic mains. Each tar-main serves five sections of hydraulic main, and falls from the centre of the bench to the tower at an inclination of 1 in 40. The tar mains and towers have been lagged, as we occasionally had trouble with the tar becoming viscid when cold winds were blowing.

Five of the ovens are fitted with bridge-pipes as shown in fig. 1 but as we found a considerable collection of tarry deposit in the bridge, we altered the design of the second five beds as in fig. 2, and I find a considerable improvement. Two 14-inch diameter foul mains each take the gas from five ovens. These mains lead into a 20-inch diameter steel main, which travels a distance of 340 feet before leaving the house.

The stage floors are formed of brick arches spanning between longitudinal joists trimmed between the main cross joists of the floor, which rest at one end on padstones in the retort-house walls, and at the other end on the buckstays. The arches are levelled up on the top with concrete, on which a blue-brick floor is laid. Cast-iron ventilating grids are built in the floor at intervals near the walls. These allow for the raising of retorts, &c., in case of repairs. On the charging side, a line of rails is fixed on the longitudinal joists for the travelling of the charging and discharging machines; and on the discharging side provision has been made for the installation of a coke conveyor when I am able to satisfy myself that there will be any real saving by its introduction.

The coal breaking and elevating plant is arranged in a coal-store on the discharging side of the house, for convenience of carting. The plant consists of a powerful double-pair claw breaker fixed in a pit below the coal-store floor level, over which pit is fixed a receiving hopper, tapered down on all four sides, and fitted with a slide door for regulating the supply of coal to the breaker. The slide door is operated by gearing and a handwheel arranged in a convenient position above the floor. The coal is elevated in the buckets of a lattice-framed elevator and delivered on to a band conveyor spanning the retort-house to the charging side, in turn delivering the coal into a shoot fitted with flap doors, which direct it into the trough of either of the two push-plate conveyors. The latter are supported on the continuous storage hoppers; each conveyor supplying five of the compartments of the hoppers.

As it is necessary to cart all the coal into the works, provision was made for ample storage. The total capacity of the continuous hopper is 120 tons. It measures 110 ft. long by 9 ft. wide by 5 ft. 9 in. deep, and is divided into ten compartments—one for each setting of retorts. Underneath each compartment three measuring-chambers are fixed, each in a vertical line with the retorts. Each chamber is fitted with an adjusting plate for regulating the quantity of coal to be charged, having a range of $7\frac{1}{2}$ cwt. to 5 cwt., in $\frac{1}{4}$ cwt. steps. The measuring-chambers are fitted with slide doors both top and bottom, together with levers and quadrants so arranged that the one door has to be closed before the other can be opened. A platform surrounds the elevator head, and gangways run alongside the hydraulic main and band conveyor and on top of the storage hoppers, for attending to the push-plate conveyor slides, &c.

The charging-machine is the De Brouwer projector, carried in a steel frame fitted with travelling wheels. The discharging machine is the "Jenkins De Brouwer" ram. This also is fitted in a steel framework carried on travelling wheels. Both machines are provided with two electric motors each, and are fitted with power hoisting and travelling gear. Short trolley arms collect and return the current from and to the bare copper conductors

stretched the length of the house, and supported at intervals on insulated brackets built into the walls.

A gas-engine of 43 brake-horse-power drives the coal plant, and also generates the current, at 220 volts, by means of a 15 kilowatt dynamo driven by belting through a countershaft. The current is carried through the switch-board to the retort-house by insulated cables protected by wood casing. The total cost of the reconstruction of the house has been as follows:—

—	Cost.	Cost per Mouthpiece.	Cost per Ton of Coal Carbonized per 24 Hours.
	£ s. d.	£ s. d.	£ s. d.
Raising walls and roof of retort-house 15 feet, and overhauling roof	1,184 10 0	7 8 1	10 11 6
Bench, settings, and all brickwork for floors	4,947 10 0	30 18 5	44 3 6
Structural ironwork, hoppers, and all retort-fittings	2,693 0 0	16 16 7	24 0 11
Coal-handling plant and measuring-chambers	1,448 10 0	9 1 1	12 18 8
Electrical equipment with two machines	1,574 10 0	9 16 10	14 1 2
Totals	11,848 0 0	74 1 0	105 15 9

The working results have been satisfactory and better than we expected. A gang of four men with the two machines work five beds of eights—that is an average of ten retorts per man. This, with 7 cwt. charges every six hours, gives 7 tons per man per twelve hours' shift. It includes the wheeling out of the coke to the yard, clinkering five furnaces, and attending the gas-engine and machines. The duties are arranged as follows: One man on the charging-stage opens the lids, works the ram and projector, closes the lids, and cleans the machines and gas-engine. One man on the discharging stage opens the lids, with the help of the coke-wheelers, augurs the ascension pipes, holds the stopper during charging operations, closes the lids, and assists at clinkering the furnaces. The remaining two men help in auguring the ascension pipes, wheel out the coke, and assist at clinkering the furnaces. The net time the men are at work in the retort-house during the shift of twelve hours is just under five hours; the machine man is occupied a few minutes longer in oiling, starting, and stopping the engine and dynamo.

The operating costs under the most favourable conditions—*i.e.*, with the maximum tonnage—are as under:

	Per Ton.
Eight men, at 5s. 3d. per shift, carbonize 56 tons, wheel out the coke, and attend to the furnaces	9·000d.
Coal elevating, labour only	1·103
Coke trimming in yard	0·992
Pipe jumping	0·352
	11·447d.
Foremen	1·103
Exhauster men	0·926
Boiler men	0·735
	14·211d.
Cost of gas generating current	0·750
	14·961d.

The first item is, of course, the principal one for comparison in working; all the other costs may vary more or less according to circumstances. In our case, some of the costs are constant, and have no relation to the amount of coal carbonized.

Repairs up to now have been practically *nil*. The total outlay has been 15s. for repairs to wires on the projector, and 10s. for new shoes on the head of the ram. The projector has charged over 14,000 tons of coal, and the ram has discharged the coke from 13,000 tons of coal. This immunity from repairs, of course, cannot continue indefinitely; but I do not anticipate that the repairs will amount to any considerable sum.

Inclined Settings.

I now propose to give you corresponding figures for our installation of inclined retorts, not with a view to disparaging the working of inclined retorts, for, in spite of the opinions that have been expressed as to this system being a thing of the past, inclined retorts still have many votaries, and we continue to read of installations being put down. When suitable coal is being used, the system is an economical one to work; it is simple in action; there are no machines to break down at awkward moments; and we have no difficulty in maintaining good and uniform heats. If the inclined method is superseded, it will be for reasons other than the above. The inclined house was completed in 1902. The dimensions of the building are exactly the same as those of the horizontal house; but the walls and roof had to be raised 25 feet instead of 15 feet. Ten beds of six's were installed; the large chimney being left in the middle of the bench. There is a coal elevating and handling plant with continuous hoppers and measuring chambers and charging shoots. The floors of the stages are of cast-iron plates.

The actual cost of reconstruction was as under:—

—	Cost.	Cost per Mouthpiece.	Cost per Ton of Coal Carbonized per 24 Hours.
	£ s. d.	£ s. d.	£ s. d.
Raising walls and roof 25 feet and overhauling roof	1,327 8 11	11 1 3	17 0 4
Cost of settings, bench, ironwork, and coal plant	12,121 0 0	101 0 2	155 8 0
Totals	13,448 8 11	112 1 5	172 8 4

It is only fair to state that these costs were necessarily higher than they would be for beds of eight built at the present time. The bench was commenced in 1898, when the building of inclined retorts was practically in its infancy; and the cost included royalties.

The working costs, taken under the same conditions as for horizontals—viz., the most favourable load—are as follows:—

	Per Ton.
Eight men, at 5s. 3d. per shift, carbonize 46 tons 12 cwt., wheel out coke, and attend to the furnaces	10·816d.
Coal elevating, labour only	1·103
Coke trimming in yard	0·992
Pipe jumping	0·352
	13·263d.
Foremen	1·103
Exhauster men	0·926
Boiler men	0·735
	16·027d.

Here the men do nine retorts per man, at 6·47 cwt. per six hours charge, or a total of 5 tons 16½ cwt. per man per shift of twelve hours. They wheel out the coke, and four men attend to six furnaces. The men work a net time of 6½ hours out of the twelve hours' shift. The same order is observed here as in the horizontal house—four men working in a gang. This is convenient for a stage-floor retort-house without a coke conveyor; one man works on each of the stages, while the other two wheel out the coke. When first started, it was expected that the charges would average 7¼ cwt. each; and on this basis four men worked five beds of six, or an average of 7½ retorts per man. Experience, however, proved that our expectations were far from being realized; and to carbonize the amount of coal desired, it was necessary to increase the number of retorts under fire. Instead of 7¼ cwt., the average of over 15,000 charges gave 6·47 cwt. each.

One of the disadvantages of inclined retorts is the variation in the weight of charge according to the class of coal being used. We have been unable to get over this trouble altogether. I append a list of average charges, extracted from a list of working tests of various coals. It will at once be seen that there is a wide range in the weight of charge obtained from different coals. This fact has to be considered when buying coal for inclined retorts; otherwise the make of gas will be found to vary considerably. It is not pleasant to find entries in the carbonizing book that charges are running thin, or that charges are not burned off on account of coal creeping.

Average Charge Obtained when Testing Various Classes of Coal and Nuts in Inclined Retorts.

Description of Coal.	Average Charge. Cwt.	Colliery.
S. Yorks. Parkgate seam cobbles through 3 in. over 1¼	6·91	A
,, ,, ,, large washed nut 2½ ,, ¾	6·90	B
W. Yorks. ,, ,, ,, ,, 1½ ,, ⅝	6·82	C
,, ,, ,, screened coal crushed	6·75	C
S. Yorks. ,, ,, ,, ,, ,,	6·86	D
,, ,, ,, ,, ,, ,,	6 84	E
,, ,, ,, ,, ,, ,,	6·52	B
,, ,, ,, ,, ,, ,,	6·19	F
,, ,, ,, double screened nuts	6·46	G
,, ,, ,, ,, ,, ,,	6·44	D
,, ,, ,, ,, ,, ,,	6·36	C
,, ,, ,, ,, ,, ,,	6·30	H
,, ,, ,, ,, ,, ,,	5·92	E
,, Barnsley seam screened coal	6·63	I
,, ,, ,, double screened nuts	6·36	I
,, ,, ,, screened small nuts	5·65	J
,, Silkstone seam screened double nuts	6·09	K
,, ,, ,, ,, ,, ,,	6·40	L
,, ,, ,, ,, coal	6·00	M
,, ,, ,, ,, double nuts	5·12	N
W. Yorks. black bed seam washed double nuts	6·20	O
S. Yorks. ,, ,, screened ,, ,,	6·15	P
W. Yorks. ,, ,, ,, ,, ,,	5·93	Q

It is, of course, a disadvantage to be restricted to one class of coal; for coalowners naturally ask for an enhanced price if they

find that you like their fuel. We buy largely nuts, preferably washed, and not less than ¾ inch in size, and of a non-slipping character. We have a 16-candle standard; and I find that the South Yorkshire coal gives us this easily without enrichment. Coal from the Parkgate seam mostly suits us well. On the other hand, coal from the Silkstone seam, which we value highly for its coke as well as for its illuminating power, has, unfortunately, a tendency to creep.

With the De Brouwer projector, the difficulty of dealing with a variety of coals is overcome by means of a rheostat regulator governing the speed of the motor, so that the velocity of the projecting belt may be varied from 1300 to 2100 feet per minute. In our case, the range of initial speed lies between 2100 and 2300 feet per minute. This speed has been obtained by experiment; and as a guide to the operator, the face of the rheostat has numbers 1 to 18 stamped around its circumference. We found no difficulty in training men to work these machines; an ordinary stoker proving an adept at the end of 14 days.

I now come to what is perhaps the most serious disadvantage of inclined retorts. I refer to the reduced make per ton of coal obtained from them. The best I have been able to do with inclined retorts over an extended period is 10,700 cubic feet of 16½-candle gas per ton of coal; with horizontals, we have had no trouble in getting 11,000 cubic feet. We have approximately the same heats, the same liquor seal, and one ascension pipe to each retort. It will be interesting to know if other managers have noticed the same results.

Briefly summarizing the merits of the two systems, it will be seen that the advantages of horizontal retorts over inclined are—

Less first cost for retort-house.
Less first cost for retort-bench.
Greater manufacturing capacity per retort.
Higher make per ton of coal carbonized.
Adaptability for any class of coal.
More economical in working.

On the other hand, it may be claimed that inclined retorts are—

Exceedingly simple in action.
There is little or no risk of a breakdown.
No machines to keep in repair.

Discussion.

The PRESIDENT said this was a paper which he thought met a want—that was, some reliable, comparative data from one particular source. They met on innumerable occasions and compared A with B and B with C with respect to the working of different plant and devices; but it was very seldom that they had presented to them so clearly the working of two different systems of carbonizing, or of any other process which they were called upon to superintend, under the same conditions, under the same management, and exactly on the same scale, as was portrayed by Mr. Auchterlonie. It was difficult for him to fill the judicial position which, as President, he ought to occupy, and at the same time to properly discuss the paper. There were a number of points he should otherwise have liked to discuss—not by any means adversely, but in the same spirit in which the paper had been prepared. But he must occupy a position that would not commit him. However, they had with them Mr. Robert Porter, of Elland, who, after many years in the wilderness, had become a convert to the inclined system; and there was no one better whom he (the President) could call upon than Mr. Porter to open the discussion.

Mr. R. PORTER (Elland) said he considered the first portion of the paper was admirable. It entered fully into detail, and gave them something they could talk over and think out when they reached home; but when he came to the second part, he was somewhat disappointed. There were facts withheld which were necessary for comparison. There was, for instance, the size of the retorts. He noticed that the amount of coal carbonized in the horizontal retorts by eight men was equal to 56 tons in the 24 hours. But when he came to the inclined settings, he found they were only beds of sixes, and the amount of coal carbonized was 46 tons 12 cwt. The same labour was occupied in carbonizing; and so the costs were very much more than under the horizontal system. The first impression he got on glancing over the paper was that the author must be somewhat biassed on the side of the horizontal system. He (Mr. Porter) had worked horizontal settings of eights with the manual charging-machine; and for the last few years inclined settings, also in beds of eights. Of course, local conditions varied very much; but the costs in his case were considerably less than those given in the paper. Considering, however, the conditions must be taken into account, he thought it was scarcely right to enter in detail into the figures. As to the expenditure on handling the coal, of course that was affected by local conditions; but it seemed to him to be excessive. In both cases Mr. Auchterlonie put it at 1·103d. for "coal elevating, labour only."

Mr. AUCHTERLONIE: It includes attending to the oiling.

Mr. PORTER remarked that he understood the item included the working of the engine and elevator plant, and keeping it in order. Still it seemed somewhat excessive; but the local conditions must, as he had said, enter into these figures. Comparisons could not be made. In his own case, the coal was brought by canal, was delivered into the elevators, and was not touched again—that was to say, about 95 per cent. of the coal received was not touched from delivery to the time it was landed into the coke yard. There was another item—the coke trimming. It cost at Cambridge almost 1d. per ton of coal carbonized. The conditions must be exceptional for that cost to enter into the account at all. It was, as the President had said, not often that they had a paper of this description brought before them by an author who had worked both systems under the same conditions at one place; consequently, it must be very valuable as a guide. But, on the other hand, he considered the advantages of inclined settings were very much greater than those claimed in the paper. The number of men employed, in the case of the inclined beds of sixes at Cambridge, was excessive, and was above the average that would be found throughout the country. He did not know whether the author had seen the returns that had been given regarding inclined settings at a meeting of the Manchester District Institution; but the number of retorts dealt with per man was greater than Mr. Auchterlonie quoted here. On the whole, he thought the results from inclined settings, where the conditions favoured them, were such that no man would leave them for horizontals. He, as the President had truly said, was a convert to inclined settings; for they had served, and were serving, them well at Elland; and he was quite satisfied they would continue to do so.

Mr. J. T. JOLLIFFE (Ipswich) said his experience only went as far as horizontal retorts; but he should like to thank Mr. Auchterlonie for his paper and for the opportunity he had given him the previous evening of seeing the De Brouwer machines at work. He must say that he came away from Cambridge perfectly charmed. He had never seen any retort-house where work was being done so sweetly and prettily as with the De Brouwer machine. He congratulated Mr. Auchterlonie upon the very efficient installation he had put up. He was, however, a little disappointed with the figures the author had given them for inclined retorts, because he had himself been rather in love with the system. It struck him it should be an ideal system for retort charging, because it seemed only sensible that, when the coal was once elevated, it should, by its own gravitation, do its own work. But Mr. Auchterlonie gave them, from his experience, figures which went to show that the inclined system was more costly than the other process. He (Mr. Jolliffe) thought the inclined retorts were either smaller than the horizontal ones, or that they were not doing the work that retorts of this size should be called upon to do. Perhaps, if he was wrong, Mr. Auchterlonie would tell them if there was any reason why retorts of the same capacity should be doing less work. The coals used certainly favoured the inclined retorts; but they also lent themselves admirably to projection by the De Brouwer machine. He had been comparing the working of the horizontal system at Cambridge with their own at Ipswich. After Mr. Porter's remarks, however, he was a little afraid to tell him his figures for coal trimming and coal wheeling; but he would give them for what they were worth. They had one of West's combined machines in use; and working the machine at its full during the month of December, as Mr. Auchterlonie had worked his, it cost them for the whole of the carbonizing wages and attending to furnaces 7·573d. per ton of coal carbonized. To this must be added the cost of 0·783d. for attending to the coke-conveyors and conveying the coke into the yard. This made a total of 8·356d. for carbonizing and conveying into the yard. But the cost of coal-handling from the unloading of the ships worked out to 2·35d. per ton. Mr. Porter grumbled at Mr. Auchterlonie's charges. What did he think of his (the speaker's) figure? Attention, however, must be paid to some variations in conditions in each individual case. At Ipswich they had to unload from ship (ship loads of 1000 tons or thereabouts) and deliver into store; and then the coal had to be wheeled out of store again, and delivered to the coal elevators and breakers for use in the retort-house. Their costs for pipe-jumping and kindred work totalled to 1·997d. per ton of coal; and he should be very glad if he could get his figure down to that of Mr. Auchterlonie. The explanation might be that they had a different class of material to deal with; or it might be that their figures included scurfing and other incidental expenses, which the author might not have included. However, their charges at Ipswich worked out at 12·703d. per ton, against Mr. Auchterlonie's 11·447d. He had practically no advantage from coke-conveying plant; and although he was loath to say it, he must confess he thought a great deal of consideration should be given before installing conveyors for coke.

Mr. R. SURTEES (Fenton), called upon by the President, observed that he had had no experience with inclined settings or with the De Brouwer projector, but had been much interested in the paper. It certainly gave them much food for thought. He should have been very pleased to have had some comparison with hand charging; but that, of course, was not the subject of the paper. The figures given by the author would certainly enable them to work out for themselves what were the advantages to be gained by inclined retorts or the De Brouwer system in comparison with their own methods of working. So far, however, as he could see, in the short time he had had the paper in his hands, there did not appear to be much to be gained either by the one or the other.

Mr. JOHN CARTER (Lincoln) thought the remarks of the President were well justified with reference to the peculiar value of a paper like this one. It was the case sometimes that they had a paper that might be described as being purely speculative in its character, brought up for the purpose of exciting expressions of

differences of opinion with very useful results. In this particular case, they had the results carefully tabulated of two distinct systems of carbonization carried on by the same gentleman, and at the same works. In considering a paper like this, they saw the work of the District Associations at its very best. He was quite sure his friend (Mr. Auchterlonie) need not have opened his paper in the apologetic strain that he did. Not one member present would be disposed to think that the subject of the paper was antiquated or out of date; on the contrary, it seemed to be one dealing with a subject that was peculiarly alive at the present moment. What were the developments they were going to see in the course of the next few months in retort-house practice, no one could positively tell; and no member of the profession could refrain from the conclusion that a paper like this must be of extreme value to those who were considering what course to pursue. Two or three years ago there was a great controversy on inclined and horizontal retorts in the Technical Press. There was one aspect of the controversy that was very prominent at that particular time, but which now appeared to have dropped altogether. Unless his memory served him wrongly, one of the great advocates of the inclined system (with which he was glad to hear his friend Mr. Porter was so greatly delighted) stated that, for one thing, it was preferable to horizontals, because the life of the retorts was so much longer; and, of course, if they gave to horizontal retorts a working life of only 400 days and to inclined retorts 1000 days, it was very easy to draw a comparison very much in favour of inclines. But he (Mr. Carter) ventured to say there were gentlemen at the meeting who had found horizontals work more than 400 days; and he should not be surprised if some of them had not worked horizontals 1000 days before being called upon to renew them. This particular aspect of the controversy had been stopped in recent years; and he thought they might assume that the advantage claimed for inclines on this point had since died away. There was another point. Mr. Auchterlonie said that in most cases their choice of appliances was limited by the circumstances in which they found themselves placed. That was just where the De Brouwer and similar chargers had rendered good service to the industry during recent years. There had been instances where the charging machinery with which they were familiar, and which had been in very profitable work in many retort-houses for some years, could not have been installed in old retort-houses simply for want of room; and there were cases in which local conditions had been such that it was not possible to provide more room in the retort-houses. In this respect, from recent descriptions of the projector type of machinery, it had met a great want—to those who could not instal machinery when they wished to, the De Brouwer and the other projectors had come to their assistance. Mr. Auchterlonie had referred to the tapering of the sides of his horizontal retorts from 21 in. to 15 in. on the charging side to 24 in. by 15 in. on the discharging side. He (Mr. Carter) would like to know whether, in the author's experience, this enlargement on the discharging side had been found actually necessary. In some cases, there was not room even to provide that; and it would be useful to know whether, in his observation of the operation of the machines, he had come to the conclusion that such a taper was absolutely necessary to prevent the jamming of the coke when discharging. With regard to the working costs, it would be remembered that they had a paper from Mr. J. Ferguson Bell at the Institution meeting in 1904; and he claimed to work the machine at even lower cost than Mr. Auchterlonie did. It was very evident from all the results they had before them that horizontal retorts, with the modern machinery they now had at disposal, could, at any rate, be worked as cheaply as inclines. Mr. Auchterlonie came to the conclusion that their first cost was less, and that this, with the other incidental advantages, put the balance very largely at any rate in favour of horizontals. It did seem to him there was a great deal in the paper that they might very fully, and with great advantage, consider. It appeared to him that horizontals might yet be said to hold the day.

Mr. F. Prentice (Ipswich) said the paper was one which had caused him a great deal of interest and a great deal of thought. The question of retort-house working, control, and management, was one of the most important to which they could bend their minds. The figures given in the paper had, to a certain extent, been compared with what they were doing at Ipswich; and, he thought, very much to their own discredit. They would certainly have to see what could be done to alter the condition of things; but he believed the local circumstances were some explanation of the differences. There were a few points in the paper he would like to ask questions about. The first thing he had jotted down was as to the tar-pots. The settings were worked with a tar-pot; and the tar was taken off automatically in this way. This necessitated someone looking after it. In their own case [Ipswich], they had a tar-pot on both sides of the house; and it was one man's job to run these off every hour, and in some cases in the winter every twenty minutes, and also to see that the seals were correct. At Ipswich they worked with governors; but he gathered that there were no retort-house governors at Cambridge. What amount of dip did the pipes have with no governors to make them quite safe as to the oscillations of the exhauster? With a make of anything like 11,600 cubic feet of 16½-candle gas, one would assume that no air must be drawn in. How this was managed he should rather like to know, as it seemed to him this was a somewhat awkward point. He should also like to know whether Mr. Auchterlonie had any trouble at all with blocked pipes. He had ascension-pipes only on one side of his retort-bench. This had not spoilt the make, as it was at one time thought it would. Apparently from the amount of his labour charges, he had no blocked pipes; and it would be instructive to know whether this was the case. It was interesting to learn that the retorts had no scurf on them at the charging end. He could only assume this was due to the rush of air that was driven in by the projector; so that at that end it was burnt off, and did not accumulate. But at the other end, there was a deposit of something like 1 inch thick in only three months. This it seemed to him would be one great advantage of this machine; for, if the bother of scurfing retorts could be done away with, better results could apparently be obtained. Several figures had been mentioned in relation to the charges given in the paper. There was one he should like to refer to—the charge for boiler men, 0·735d. per ton. It seemed a small figure indeed; and he thought it must only be a partial charge—that some of the boiler costs were charged to other parts of the works, instead of to the retort-house itself. As to the projector band, he had gathered the impression from somewhere that the bands which carried, or projected, the coal into the retorts, wore out very rapidly; and it seemed to him that Mr. Auchterlonie had secured a band of an improved kind, of which he (Mr. Prentice) would like some description. They learned that it had already charged more than 14,000 tons of coal into the retorts without wearing out. There was only one other point. The coke coming from a retort holding 7½ cwt. of coal would be rather a lot to be pushed out by the ram into a barrow. He should like to know how it was quenched. It seemed to him that coke coming out rapidly in such large quantities required a number of men to deal with it—to quench it, and to get it away quickly.

Mr. W. H. Mainwaring (Lincoln): What is meant by "coke trimming in yard"? Does it include filling the fires?

Mr. Auchterlonie: Yes.

Mr. W. J. Jenkins (Retford), invited by the President, said that when one stood somewhat in the relation of a parent to anything, it was only to be expected he would be inclined to speak rather too highly in favour of it. At the same time, he thought he could detach himself sufficiently from the De Brouwer projector to speak without bias, seeing that his firm had on many occasions built inclined retorts. Therefore he was in the position to see and say where differences lie between the two systems. He might, however, first of all mention that to Mr. Auchterlonie's considerable courage they all owed a great deal. When Mr. Auchterlonie took up this question first of all, horizontal taper retorts and one ascension-pipe to a retort were exceptional; but the excellent results he had obtained by the use of these innovations should return him some credit for having had the courage to adopt them. With regard to the comparison between inclines and horizontals with stoking machinery, a great deal might be said with respect to the saving. But for the purposes of comparison, there were difficulties; for in the published particulars they often found certain figures were included in the cost of working inclines, and other essential ones were left out. He (Mr. Jenkins), however, did not think it was possible to compare two different places, as had already been said, on a fair basis; they must have two installations in the same works, and under the same conditions. At Cambridge they were fortunate in having two installations in the same works, and the retorts of the same size; and in another place (which had better be nameless) of which he knew something, they had large retort-houses on both the inclined and horizontal systems, and fitted throughout with coke-conveyors by the same maker. In this case, carbonizing costs, including the taking of the coal out of the trucks and the delivery of the coke into railway waggons under the coke-hoppers, were less than 8¾d. per ton with horizontal retorts and the De Brouwer machinery. With the inclined installation, it was nearer 1s.; so that Mr. Auchterlonie was entitled to say his figures were borne out, comparing his small installation with a large one. He (Mr. Jenkins) noticed that Mr. Jolliffe compared his costs when he was working at his maximum in December with Mr. Auchterlonie's, also working at his maximum. He did not think that was altogether a fair statement. Mr. Auchterlonie's machinery was quite competent to charge five times the quantity of coal mentioned in the paper; and if he had five times the amount of coal to handle, he (Mr. Jenkins) felt quite sure he would be able to reduce the labour charges upon it, because, as he pointed out, some of these charges were not varied in proportion to the amount of coal carbonized. Also in a case like this, it would be worth while inventing some better means of taking the coke out; the removal of the coke forming a great proportion of the costs. He should like to mention the question of scurfing, because they had something like thirty installations of projectors working in England. The results as regarded the scurfing of the retorts varied very greatly; and they not only varied in degree, but in time. In one case, for example, they found very little scurf was formed except at about 4 feet from the end of the retort, with the same result that Mr. Auchterlonie mentioned—that the scurf was probably 1 inch thick in three months. Then in another case, they had an installation of 20-feet retorts, in which they had 3 inches of carbon formed in the first three weeks near the discharging end; and, indeed, the amount of carbon in different places had varied from practically nothing up to 3 inches

in a few weeks. But the amount of carbon depended upon the pressure in the retort, and not so much upon the charger. If the pressure was great in the retort, there would be a considerable amount of carbon formed, in spite of the action of the slight breath of air that passed through owing to the action of the projector. They had heard that an "enormous blast" of air passed through the retort, due to the operation of the machine; but it was, as a matter of fact, as he had described it, only a "breath" of air, so slight that it would scarcely move a handkerchief held near the belt. With regard to the projector band, it must be borne in mind that, at first, M. De Brouwer's installation was working in a small retort-house; and he used a leather band as being the thing most available for his purpose. Another important item was that M. De Brouwer also stored his coal, and seldom used it wet. That first band had charged up to 6000 or 7000 tons of coal. They had exactly the same kind of band on the same kind of machine in England; and the first coal they had to charge was wet small nuts—so wet that they could catch a bucket of water per charge off the band. The belt only lasted some 4000 tons. But the belt did not wear out; it went wrong at the joints. The joints got wet—the belt in fact was wet through; and when it came to dry, the joints gave way. Of course, a leather belt must have joints in it. They then tried several other kinds of belts, and finally they found that a rubber belt was the best of all, consisting of a three-ply canvas body with a raised path on it of $\frac{7}{16}$ inch thick good rubber. This belt was waterproof, and did not crack when running. The rubber would stand 16,000 tons of coal passing over it. If, however, they left the machine standing in front of the retorts, without providing something in the way of protection from direct radiation, the belt would become overheated; and in such a case the belt cracked almost immediately across the face. He had known an india-rubber belt do no more than 7000 tons through this cause; but so long as the belt was kept running, it could stand as near a fire as they liked without injury. He would like to draw attention to one or two points bearing upon the figures in the paper; but as he was equally interested in inclined retorts and horizontals, he did not wish to say one word to run either system down. In his opinion, inclined retorts, when they had a suitable coal, or the conditions were favourable, as Mr. Porter remarked, would do quite as good work as horizontals. But the horizontals had the great advantage that they would do the same good work, regardless of any question as to suitability of coal. He meant that no regard need be paid to the question as to whether the coal was of one quality or not. That was a great advantage that the horizontal retorts had over the inclines. The question of the breakdown of stoking machinery was, in his opinion, made a great deal more of than need be. Anyone using the West or the Arrol-Foulis machines, knew that breakdowns might happen on perhaps two or three days in the year. But two or three days in a year could not be considered a serious matter. He really did not think that such breakdowns of machines ought to weigh to their disadvantage.

The PRESIDENT observed that Mr. Jenkins's advocacy on the latter point would be improved if he could only specify the particular days on which the breakdowns should occur.

Mr. JOHN YOUNG (Hull), called upon by the President, said he must compliment Mr. Auchterlonie on the exceeding fairness with which he had tried to hold the balance between the two plants he had at work at Cambridge. At the same time, it must not be forgotten that Mr. Auchterlonie had compared settings of eight horizontals of the latest and best type with the work done by settings of sixes on the inclined system; and therefore the costs he had given (which were, of course, carefully worked out) were not to be taken altogether as a criterion of work as between the two systems. Mr. Auchterlonie had simply given them the benefit of the existing conditions he had at Cambridge. But if he had settings of eight inclines that were fairly comparable with the horizontal settings of eights, Mr. Auchterlonie would, he thought, find that his costs from the working of the two systems would be fairly similar. He (Mr. Young) had a retort-house on the inclined system; and, like Mr. Porter, he agreed that circumstances altered a good deal. Therefore figures applicable at Hull were not fairly comparable with those at Cambridge. The difference between his inclined-retort settings and those worked by Arrol-Foulis machines was very considerable, and was much in favour of inclined settings—so much so, in fact, that he hoped to duplicate the inclined plant that they had there. He did not know there was anything else for him to tell the members, excepting perhaps a little piece of history with respect to the single ascension-pipe to a through retort. Over 35 years ago, his uncle adopted the system of only one ascension-pipe, 8 inches diameter, for a 20-feet retort. His uncle never knew what a stopped pipe was; and his results were equally as good as anyone's, if not better. He (Mr. Young) was quite sure that anyone reading Mr. Auchterlonie's paper would not think he was biassed in favour of one system or the other. One feature of the paper was the extreme fairness with which the author endeavoured to set before them the advantages and disadvantages of both systems.

Mr. PORTER asked to be permitted to refer to two important subjects that had not been discussed in connection with these settings. The first was the make of gas per ton. He believed the author told them he obtained an average of 300 cubic feet more out of the horizontals than the inclines. His (Mr. Porter's) experience, after two years' working with inclines, was that the make of gas per ton was a little over 11,200 cubic feet; and the average sale for the two years ran out at 10,400 cubic feet. This exceeded anything they obtained with horizontals. The next point the author had omitted was the fuel consumption for heating the retorts. Perhaps he would have something to say on this head in his reply.

Mr. AUCHTERLONIE, in reply, said he was sorry that Mr. Porter thought that he was biassed on the side of horizontal retorts; for if there was one thing he did deprecate it was bias in the setting forth of figures. The figures he had given were absolutely unbiassed.

Mr. PORTER: I think I stated that my *first* impression was that the author was biassed.

Mr. AUCHTERLONIE said he could assure the members that he did not start with any bias against inclines. Until they had the De Brouwer machines, he entertained the greatest respect for inclines, and with selected coal was satisfied with their working. As to the size of the inclined retorts, in five settings they were 21 inches tapering to 24 inches, and in the other five beds 22 inches parallel. Approximately, therefore, they were the same size as the horizontals. Mr. Jolliffe had remarked upon the cost of pipe-jumping being a little low. The explanation was that the coke-trimming men did the pipe-jumping during the night; this made the cost for coke trimming a little high. As to the cost for coal handling, they had two coal-handling plants—one for each house; and this necessitated a man to each house, making the item rather high. One man really did less than 40 tons a day; so that the coal-handling charge was capable of considerable reduction if they had the whole house working. If the arrangements were suitable, they could, during seven or eight months of the year, do the whole of the work with one coal-handling plant, and with one man less per day. With regard to the illuminating power of the gas, it should be explained that the tests were made by the official tester up-town. They supplied 16½-candle gas a mile from the works; and they had no difficulty in maintaining that. The heats of the inclined and horizontal settings were practically the same, tested with the Féry pyrometer. He had never been able to get a greater production than 10,700 cubic feet with the inclined retorts. His 1905 Michaelmas quarter's returns, when working inclines only, were just under 10,700 cubic feet; but with the horizontals working during the Christmas quarter, they had averaged 11,000 cubic feet for the half year. This wanted some explanation. They had had no more trouble to get 11,000 cubic feet per ton from the horizontals than to get 10,700 cubic feet from the inclines. He thought he had stated that there was not a great deal of saving between the settings, so far as the number of men employed was concerned. The main features of difference between the systems were: In respect of first cost, they had to build the walls of the house 10 feet higher for the inclined settings; and, of course, there was more brickwork in the bench. Then they could not always get in 7 cwt. charges. The best charges he had got only showed 6·9 cwt. per charge; and they had no difficulty in getting 7 cwt., and a little over, into the horizontal retorts with the projector. As to the fuel account, the "Gas World" Analysis put the coke and breeze sold at 9·9 cwt. per ton of coal carbonized. This figure had been taken from the balance-sheets, which only showed coke sales, and did not include breeze. Therefore this figure should be much higher.

Mr. PORTER: Does that refer to both settings?

Mr. AUCHTERLONIE replied in the affirmative. They both had deep producers. If the settings were both eights, they would be practically the same. The question of scurfing had also been referred to. They only had scurfing to do once in three months; and it was placed under the special charges he had given. As to the carbonizing charges, he had a statement, dating from 1884, showing the wages paid per ton. In that year, the wages per ton of coal carbonized were 4s. 9d., with hand charging. The cost had ranged from about 4s. to 4s. 9d. right down to the starting of the first half of inclines, when it dropped in the first six months to about 2s. 4d. per ton. For the past half year the cost had been 1s. 9½d.

Mr. SURTEES: What does that include?

Mr. AUCHTERLONIE: That is the whole of the carbonizing wages right up to the purifiers. The charges were exactly similar—that was to say, the costs on precisely similar lines were exactly 3s. less than in 1884. As to Mr. Carter's remarks, he (Mr. Auchterlonie) had some inclined retorts that had been let down within the past two months which had been working just 1000 days; so that there was nothing unusual in getting 1000 days' work. As to the choice of systems, he had had to limit his selection somewhat, owing to the width of the house; and it resolved itself into inclines or De Brouwer machines. They did not jump at the latter system without giving it a considerable amount of thought. Regarding the tapering of the retorts, he did not think it was necessary to taper them; but he thought it would certainly facilitate the discharge of the coke, and it might save scurfing as often as they might otherwise have to do. Respecting Mr. Prentice's question about the tar-pot, it was the carbonizing foreman's duty to draw off the tar from the pot after each charge. A constant stream of liquor flowed through the hydraulic mains and weir-valves, or the tar-pot regulated the seals. They had no governor in the houses, and, in fact, he did not see that they needed one, as they had no difficulty in governing the exhausters. They worked with about 1-inch seal. Concerning stopped ascension-pipes, they had had very little trouble at the present time; but they had some at the

start. At first, a cone of hot coke was left in the retort, instead of holding in the stopper. But when they did this, they had stopped ascension-pipes, so that they gave up the practice, and reverted to the holding in of the stopper. They had also had trouble with the tar-main; but that was owing to cold winds, and probably to the high heats leaving the tar viscid. Since then there had been no trouble. As to the removal of the coke, it dropped into barrows; and they had a system of pipes underneath the stage for quenching. All the men did was to pull a lever; and, from a pipe pierced with holes, the coke was drenched with water.

Mr. PRENTICE: The coke comes out so quickly that it seems to me you would want a row of barrows.

Mr. AUCHTERLONIE replied that they had only two or three. As to the boiler-men, they had two who were paid 4s. 6d. each. The figure in the paper was calculated on the maximum make. The boiler-men raised the steam for the coal-elevators, and performed sundry other little duties. It was all charged in carbonizing; and the figure in the paper included this. As to the rubber band, it showed signs of wear on the side where the wheel rubbed. Perhaps he might be able to do 16,000 tons with it, but he did not yet know. It was, however, still going well. As to a coke-conveyor, he had not yet adopted one. He had made provision for it, if he should be able to see his way to introduce it. As to breakdowns, it was true there was more or less danger of such occurrences with machine charging; but the risk was small. Mr. Young said it was scarcely fair to compare settings of sixes and eights. This was true, as far as first cost and fuel consumption was concerned; but it only affected the labour to the extent of attendance on an extra furnace. Some of the members thought that more work per man might be accomplished at Cambridge. This was quite possible; but it had to be pointed out that the men in the inclined house had to work 6½ hours to carbonize the quantity of coal stated, whereas the men in the horizontal house only worked 5 hours. Therefore it would be more reasonable to expect improved labour efficiency in the horizontal house than in the inclined house. He concluded by expressing his appreciation of the reception accorded to the paper.

ELECTION OF OFFICERS.

Moved by the PRESIDENT, and seconded by Mr. J. G. HAWKINS (Wisbech), Mr. E. J. Brockway (Cleethorpes), was unanimously elected President for the ensuing year.

Mr. BROCKWAY thanked the members for the high honour they had done him in electing him their President. He was quite certain they would appreciate the difficulty he felt in following such a President as Mr. Shadbolt. As far as his ability would allow him, however, he would do his best to maintain the dignity of the position and the interests of the Association.

Mr. J. H. TROUGHTON (Newmarket) moved that Mr. Joseph Davis be elected Vice-President. They had not often been south. He believed, however, that when Mr. Davis came to the chair he would invite them to Gravesend; and the members would be very pleased to go.

Mr. RUGGLES seconded the motion, which was carried.

Proposed by Mr. WIMHURST, and seconded by Mr. ARTHUR GRAHAM (Mansfield), Mr. Guyatt was re-appointed Hon. Secretary and Treasurer.

On the motion of Mr. BROCKWAY, seconded by Mr. WALTER SHADBOLT (Horncastle), Mr. H. Wimhurst (Sleaford) and Mr. T. Dann (Bedford) were appointed Auditors, in place of Messrs. Panchen and Witten.

Mr. J. YOUNG (Hull) moved, and Mr. T. SHADBOLT (Biggleswade) seconded, the election of Messrs. J. W. Auchterlonie and Thomas Glover as members of the Committee.

PLACE OF THE AUTUMN MEETING.

Mr. CARTER said the Association was now 17 or 18 years old; and its operations extended from the Humber to the Thames. They might not have to wait until their Vice-President reached the chair before visiting the southern end of their district. They had had an intimation that they would be very welcome at Tottenham for the autumn meeting of this year; and he therefore proposed that their next meeting should be at Tottenham.

Mr. W. H. MAINWARING (Lincoln) seconded the motion.

The PRESIDENT remarked that they had had a most cordial invitation to visit the Tottenham and Edmonton Gas Company's works; and Mr. Broadberry (who was one of their members) would, he was sure, make the visit a most enjoyable one.

The motion was heartily agreed to.

VOTES OF THANKS.

Mr. W. D. CHILD (Romford), in proposing a vote of thanks to the President, the Hon. Secretary, and the Committee, said that Mr. Shadbolt had been one of the most useful members of the Association, and the members generally were indebted to him for a number of subjects of great interest. Mr. Shadbolt had done everything that was possible for its benefit; and since he had been elected President, he had added still more by bringing forward new subjects for consideration, and in such a way as would ultimately prove of benefit to the gas industry generally. The high esteem in which they held their President was shared by the inhabitants of that ancient borough, and also by the Chairman and Directors of the Company. He hoped Mr. Shadbolt would live long to enjoy his deserved popularity. They had also to acknowledge the great amount of work the Hon. Secretary and the Committee had done for the members.

Mr. J. H. TROUGHTON (Newmarket) seconded the motion, and it was heartily carried.

Votes of thanks were also passed to the retiring Auditors (Messrs. Panchen and Witten), on the motion of Mr. CARTER, seconded by Mr. S. SHADBOLT (Kirkby-in-Ashfield); and to Mr. Auchterlonie for his paper, on the proposition of Mr. J. BARTON (Peterborough), seconded by Mr. CASTERTON.

COMMERCIAL SECTIONS AND OTHER TOPICS.

The PRESIDENT said the members had been welcomed by the Mayor and by the Chairman of the Gas Company; and he thought he would be somewhat remiss if he did not also take the opportunity of offering the members a welcome as their President to the town in which he resided and worked. The first general meeting of the Association was held at Grantham 17 years ago, when his predecessor Mr. Barratt occupied the presidential chair. He (the President) could not help wondering when reading that report what would be Mr. Barratt's feelings if he could see their Association that day, with its increase in numbers, activity, and usefulness. To peruse the "Transactions," particularly in view of their commercial movement, one was greatly struck with the preponderance of commercial thoughts and matters which marked the first meeting at Grantham. The President's address was then more commercial than technical; and they had with them that day Mr. Barton and Mr. Carter, who adorned the "Transactions" on that occasion with remarks upon the rating of gas-works, consumers' fittings, &c. Was it not a matter for reflection that it had taken them 17 years to proceed from that stage to the stage they had now reached with regard to Commercial Sections? The Commercial Sections which had been formed in connection with the Association had been met by certain objections. It was only to be expected; but the objections generally had been, in his opinion, of a somewhat short-sighted nature. He should like to ask the members to consider the possibilities there were in supporting these Commercial Sections. The principal objection met with had been: "I do not think the Commercial Section will benefit the market in which I have to sell this, or that, or the other." He should like to submit that this was altogether the wrong spirit in which to approach the thing. A man who joined the Association with the sole reason of benefiting himself without any regard to benefiting others was in the first place a very selfish individual. Was it not much better to place this question on a higher and broader basis, and give consideration to it not so much from the point of view of how much one could benefit himself, but from that of the extent that one could forward the progress of the industry in which they were all engaged? He wished to emphasize what one could not impress too strongly or too often, that it was not only a matter of coke or coal or residuals with which these sections had to do; and naturally they would not be the success that they ought to be unless they gathered within them the whole of the gas undertakings in the district belonging to gas companies and local authorities. Until they were all members, the sections would be stultified to some extent. He made these remarks for the purpose of, if possible, inciting the members who felt lukewarm towards the movement. He asked them to consider the matter carefully, so that they might have a wider field of experience and of practice from which to draw their information, to their mutual benefit. Though the sections started well, they would not be as perfect or as useful as they would be if they had the whole bulk of the members attaching themselves to one or other of the sections. The President then distributed specimens of advertisements that the Gas Company insert in the local papers, and to the character of which he drew attention. He could not say what had been the £ *s. d.* value of these advertisements; but this he did know, that the public would miss them if they were now dropped.

VISIT TO THE GAS-WORKS.

The members next visited the gas-works, and inspected the plant under the care of their President. It may be remembered that it was described in a paper read by him when the Manchester Institution visited Grantham in September, 1901; and memory can be refreshed by referring to the publication then made. The feature of greatest interest was undoubtedly the arrangements connected with the gas blending process as described in the presidential address at the Cleethorpes meeting last autumn. Some modifications have been made by which the carbonic acid has been reduced, the calorific power of the gas raised, and other advantages realized. But these modifications are as yet in a more or less tentative position; and until the arrangements assume a definite character, Mr. Shadbolt prefers not to publish anything more. He is, however, sticking to his investigations, and is pleased with what he has so far achieved.

Later, the members dined at the Guildhall, with the President in the chair. The Mayor, the Chairman of the Gas Company, the President of the Institution of Gas Engineers (Mr. Charles Wood, of Bradford), and a number of local gentlemen were present as guests.

A party of the members the following morning paid a visit to the famous works of Messrs. R. Hornsby and Sons, Limited, and in the afternoon enjoyed a visit to Belvoir Castle.

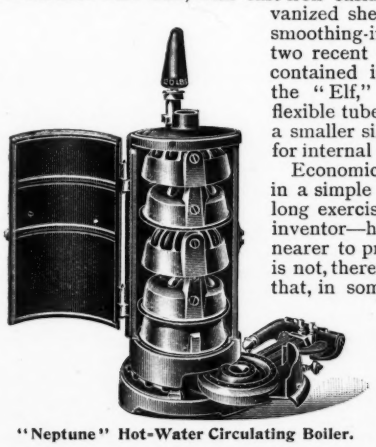
COOKING AND OTHER GAS APPLIANCES.

The remarkable figures that were supplied at the Smoke Abatement Conference in London a few months ago were eloquent of the great popularity of the gas cooking stove and other domestic appliances, but they also demonstrated the fact that, extraordinary and gratifying as the figures were, there is still an enormous field for further development. When this is considered, it is not at all surprising that our gas-stove makers are ever on the alert to secure improvement in their goods, and particularly of the kind which have the most extensive use in summer. It is in those lines that there has been a greater encouragement to the makers than in the gas-heating branch; and therefore it is upon cooking and other kitchen appliances that they greatly depend for business success, and to them they devote a large share of attention.

Among the other enterprising firms rank the Richmond Gas Stove and Meter Company, Limited; and what has been said above is suggested by the various additions and improvements that the Company have made to and in their already extensive range of gas cooking and heating appliances for the season just at hand. Since the production of the very effective and well-arranged "Crusader" line of cookers, new ranges have been designed to meet the requirements of the general trade. The "Academy" cookers, for instance, embody essentials which long experience has suggested. They are jacketed throughout in all cases, and are made with either cast iron or enamelled sheet steel exterior, sheet enamelled interior, and swing-out shelf hangers. While simple in design—thus facilitating easy cleaning—they are chaste in outline. All the burners are loose for cleaning; the hot-plate bars are loose and of wrought iron, and so may be readily renewed. A good field seems open for this line of ranges; and for hiring out they should meet with approval.

"Blackpool" Wash-House Boiler.

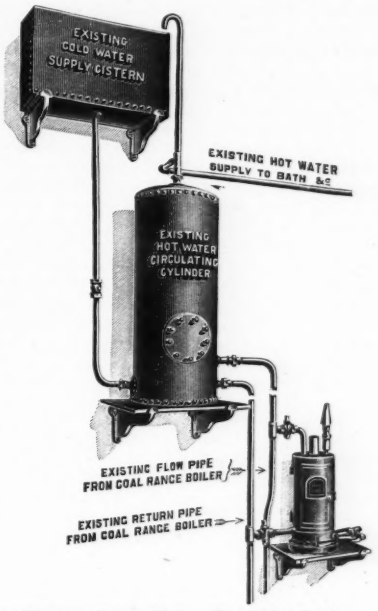
In the smaller class of apparatus, the "Bridgnorth" hot-plate is an efficient, neat, and compact article, especially for placing upon the hot-plate of ordinary coal-ranges. Grillers have also received attention. The low prices which this type of goods has now reached are noticeable; and they have had the effect of making simplicity of form and action imperative. Wash-house boilers heated by gas are also becoming increasingly popular—more especially in various industrial centres—and are hired out by many gas companies. "Once used, always used" may be truly said of these; for no housewife after experience with them would revert to the old troublesome form of copper. The "Blackpool" and "Fleetwood" patterns are examples of the firm's productions in these lines. The former is made in various ways—the more complete one having a copper boiler, galvanized sheet body, and galvanized cast-iron top (with combined steam-flue) and stand. The simpler form has rustless cast-iron boiler, and galvanized sheet body and cover. The "Fleetwood" boiler is of rustless cast iron, with cast-iron casing and stand, and galvanized sheet cover. Household smoothing-irons have, it is noticed, two recent additions—a new self-contained internally heated iron, the "Elf," for attachment by a flexible tube to a gas-bracket; and a smaller size of the "St. Helens" for internal heating on a stand.



"Neptune" Hot-Water Circulating Boiler.

Economic water heating by gas in a simple way—a problem which long exercised the ingenuity of the inventor—has of late come much nearer to practical realization. It is not, therefore, surprising to learn that, in some of the heaters now manufactured by the Company, a high duty is obtained from the quantity of gas consumed. Calling for special notice is the "Neptune" pattern of circulating heater, for connecting up to the ordinary domestic service at any convenient place between the range boiler and the circulating cylinder; or, of course, it may be connected to a circulating cylinder quite independently of any other source of heat. It has, as is seen from the illustration, a double concentric burner, the smaller ring of which, consuming 8 cubic feet per hour, is sufficient to keep up an ordinary supply of hot water; the larger one, 16 cubic feet per hour, being merely used at times for quicker work.

This notice commenced with a reference to the great expansion of the gas-stove business; and the Richmond Company supply another indication of this. While their production has been constantly on the increase, opportunity for proportionate extensions of the works, in the midst of a growing population, has been out of question. New works, outside Warrington, covering nearly 10 acres of ground, have therefore been decided upon; and it is learned that operations will have to be shortly commenced to provide for the immediate future of a business which shows no present signs of settling down to any definite limits.


EXISTING COLD WATER SUPPLY CISTERN
EXISTING HOT WATER SUPPLY TO BATH &c
EXISTING HOT WATER CIRCULATING CYLINDER
EXISTING FLOW PIPE FROM COAL RANGE BOILER
EXISTING RETURN PIPE FROM COAL RANGE BOILER

"Neptune" Hot Water Circulating System.

NATURAL GAS IN THE UNITED STATES.

In the course of some articles on the above subject in the "Chemical Trade Journal," particulars were given in regard to the uses to which the natural gas produced in the United States in 1904 was put, as reported by 2347 persons, firms, and companies. The figures are reproduced in the following table:—

State.	Domestic Consumers.	Manufactories, Works, &c.
Pennsylvania	238,481	2929
Ohio	232,557	1136
Indiana	84,862	390
West Virginia	44,563	1005
New York	67,203	451
Kansas	27,204	298
Kentucky	11,495	57
Tennessee	1	1
California	3,757	14
Colorado	372	3
Texas	221	2
South Dakota	253	2
Missouri	181	1
Illinois	92	2
Arkansas	96	4
Wyoming	..	2
Indian Territory	1,239	35
Alabama	..	1
Total	712,577	6333

There was an increase of only 18 in the companies and individuals reporting in 1904 over 1903; while the number of consumers supplied with natural gas increased by 85,530. There was a decrease of 889 in the establishments supplied. A large proportion of the decrease was due to the diminished pressure and the small supply in the gas-fields of Indiana and North-West Ohio. A number of the iron and steel plants and glass manufactories in Pennsylvania and West Virginia have their own natural gas plants. During the summer months, owing to the light domestic trade, it is customary for the natural gas companies to supply temporarily a number of manufactories. The great bulk of the consumption is for domestic purposes. There were 712,577 domestic consumers supplied in 1904—an increase of 85,530 over 1903. It came chiefly from Ohio, Pennsylvania, Kansas, New York, and West Virginia. Indiana showed a decrease. It is estimated that not less than 4·6 million individuals were supplied with light and fuel, and not less than 5 million individuals received benefit from its use as an illuminant.

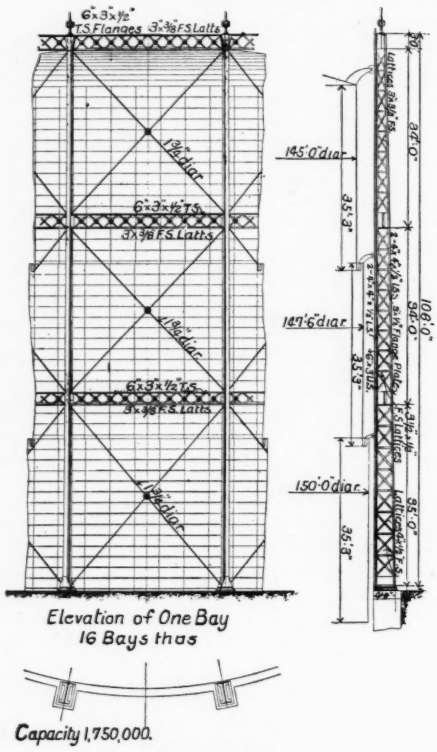
COMPARISONS IN GASHOLDER DESIGN & NOTES ON PRESERVATION OF STRUCTURAL STEELWORK.

By R. Nelson, of Hull.

[A Paper read before the North of England Gas Managers' Association, April 28.]

Having occasion a short time ago to examine the strength of the guide-framing of a 150-feet diameter holder, and, during that examination, of comparing the sections of this holder with others that have been erected in the last three or four years, it was suggested that, if these comparisons were tabulated, they might possibly be of value to members of the Association, and especially to those contemplating the erection of such structures.

The holder in question is of three lifts; the outer one being 150 feet in diameter, and the depth of each lift 35 ft. 3 in. The position is near the coast, and fairly exposed—especially so when the holder is working in all three lifts. Dealing, in the first place, with the guide-framing of this holder, which we will distinguish by the letter "A," it consists of 16 latticed steel standards, braced together with three tiers of girders and diagonal wind ties, as shown on Drawing No. 1. The height of each standard is 106 feet from the base-plate to the underside of the cast-iron finial. The flanges are built up of angle steel braced together by flat steel-lattices. The back flange consists of two 4 in. by 4 in. by $\frac{1}{2}$ in. L steel and a plate 9 in. by $\frac{1}{2}$ in. The front flange consists of two 4 in. by 4 in. by $\frac{1}{2}$ in. L steel only. The lattices up to the first tier of

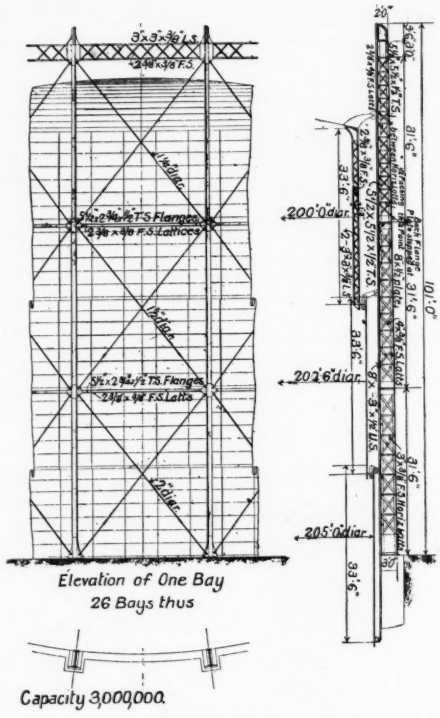


Drawing No. 1.

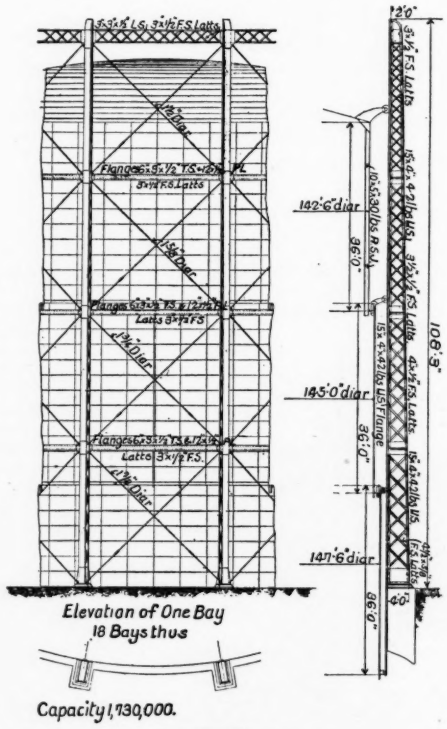
girders are 4 in. by $\frac{1}{2}$ in. flat steel; from the first to the second tiers, $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. flat steel; and from the second to the third tiers, 3 in. by $\frac{3}{8}$ in. flat steel. All web plates are $\frac{1}{2}$ inch thick.

The width of the standard at the base is 4 feet, tapering to 2 feet at the top. The total sectional area of both flanges is $19\frac{1}{2}$ square inches. All the girders are built up of 6 in. by 3 in. by $\frac{1}{2}$ in. T steel flanges, braced by lattices of 3 in. by $\frac{3}{8}$ in. flat steel. The depths of the girders are as follows: First tier, 2 ft. 6 in.; second tier, 2 ft. 9 in.; third tier, 3 feet. All the wind ties are $1\frac{3}{4}$ inches in diameter, connected in the centre by flat steel rings, as shown.

Passing on, for comparison, to the guide-framing of holder "B" (Drawing No. 2), it may be stated that it is to the designs of a well-known Continental gas engineer, and is again of three lifts; the outer lift having a diameter of 205 feet, and each lift being 33 ft. 6 in. deep. In this case, there are 26 standards, each 101 feet high, and 3 feet wide at the base, tapering to 2 feet at the top. The standards are composed of $5\frac{1}{2}$ in. by $5\frac{1}{2}$ in. by $\frac{1}{2}$ in. T steel flanges; the back flange being stiffened by means of a plate, 8 in. by $\frac{1}{2}$ in. This back plate is only carried up to the height of the second tier of girders, after which the section simply consists of the aforementioned T steel. The lattices are 4 in. by $\frac{3}{8}$ in. flat steel up to the second tier of girders; and from this point upwards, $2\frac{3}{8}$ in. by $\frac{3}{8}$ in. flat steel. The diagonal lattices are single members, placed alternately on each side of the web of the T steel; the horizontal members are double, with $\frac{1}{2}$-inch packings between to make up for the thickness of the flange T. The web-plates are $\frac{5}{8}$ inch thick, with $\frac{1}{2}$-inch packings at the base only. The total sectional area of this standard at the lower portion is $14\frac{1}{2}$ square inches. The first and second tiers of girders are fixed on edge, and consist of $5\frac{1}{2}$ in. by $2\frac{3}{4}$ in. by $\frac{1}{2}$ in. T steel flanges latticed with $2\frac{3}{8}$ in. by $\frac{3}{8}$ in. flat steel. The top girders are "box" section



Drawing No. 2.

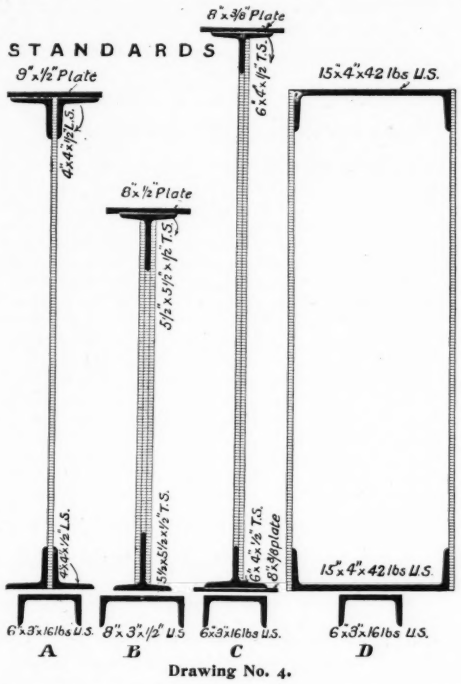


Drawing No. 3.

3 feet deep, built up of 3 in. by 3 in. by $\frac{3}{8}$ in. L steel, latticed together by means of $2\frac{3}{8}$ in. by $\frac{3}{8}$ in. flat steel. The wind-ties are 2 in., $1\frac{1}{2}$ in. and $1\frac{1}{4}$ in. diameter respectively.

The guide-framing of holder "C" is of a somewhat similar construction to the one last described. In this case (again three lifts), the outer lift is 122 feet diameter, and each lift 30 ft. 9 in.

deep. There are 14 standards, each 94 feet high, tapering from 4 ft. 6 in. to 2 ft. The standards are shown on Diagram No. 4, and consist of 6 in. by 4 in. by $\frac{1}{2}$ in. T steel flanges strengthened by 8 in. by $\frac{3}{8}$ in. back and front flange plates. The lattices are 4 in. by $\frac{1}{2}$ in., 4 in. by $\frac{3}{8}$ in., and 3 in. by $\frac{3}{8}$ in. flat steel in their respective bays, fixed alternately on each side of the standard T, and are diagonal members only. All the webs are $\frac{1}{2}$ inch thick, single in each case, riveted to one side of the T steel. The



Drawing No. 4.

sectional area of this standard is 15½ square inches. There are three tiers of girders, each being 2 feet deep; and all are built up of 6 in. by 3 in. by $\frac{3}{8}$ in. T steel flanges latticed with 2½ in. by $\frac{3}{8}$ in. flat steel. The wind bracing is composed of rods, adjusted by turnbuckles, 1½ in., 1$\frac{3}{8}$ in., and 1¼ in. in diameter.

These three holders, "A," "B," and "C," were chosen for comparison on account of the light designs of the structures, and also because the standards were of a very similar character. It may be mentioned here that holder "A" has now been in use about ten years.

To enable a comparison to be made with a holder of a similar size, but with a standard of a somewhat different design, attention might now be directed to holder "D" (Drawing No. 3). This is also a three-lift holder; the outer lift being 147 ft. 6 in. in diameter, and each lift 36 feet deep. In this case, there are 18 standards, braced together by four tiers of girders and four bays of wind-ties. The standards are 108 ft. 3 in. in height, tapering from 4 ft. to 2 ft.; and each flange consists of a single 15 in. by 4 in. by 42 lbs. ⊔ steel, latticed by 4½ in. by $\frac{5}{8}$ in., 4 in. by ½ in., 3½ in. by ½ in., and 3 in. by ½ in. flat steel between each tier of girders respectively. The cross section of this standard is shown on Diagram No. 4. All web and junction plates are ½ inch thick. The total sectional area of both back and front flanges is 22 square inches. The first, second, and third tiers of girders are placed on edge, and are built up of 6 in. by 3 in. by ½ in. T steel flanges, with a 12 in. by ½ in. plate riveted on to the table of each T. The lattices are 3 in. by ½ in. flat steel. The top girders are "box" section, composed of 3 in. by 3 in. by ½ in. L steel and 3 in. by ½ in. flat steel bracings. The wind-ties are 1$\frac{7}{8}$ in., 1¾ in., 1$\frac{5}{8}$ in., and 1½ in. diameter respectively.

The last design of guide-framing to which your attention is desired, is of still heavier construction, and worthy of comparison with the four already described. This is called holder "E;" and the section of the standard is shown on Diagram No. 5. The diameter of the outer lift is 150 feet; and each lift (of which there are three) is 30 feet in depth. The standards are 18 in number, with three tiers of girders and diagonal bracing. The standards are built up of 6 in. by 6 in. by ½ in. T steel, with 15 in. by 4 in. by ½ in. ⊔ steel riveted to the tables of same. The section is symmetrical; each flange consisting of the aforementioned members. The standards taper from 4 ft. 9 in. to 2 ft. 6 in. The lattices up to the first tier of girders are 5 in. by 2½ in. by $\frac{7}{16}$ in. ⊔ steel; from the first to the second tiers, 4½ in. by 2 in. by $\frac{7}{16}$ in. ⊔ steel; and for the remainder of the height, 4 in. by 2 in. by $\frac{3}{8}$ in. ⊔ steel—all being spaced very wide. All cranking and welding of sections is dispensed with; packings being introduced wherever necessary. The sectional area of this standard is 33½ square inches. The first tier of girders is composed of 6 in. by 3 in. by $\frac{3}{8}$ in. T steel flanges, with 10 in. by ½ in. cover plates riveted on both, and braced with lattices of 2½ in. by 2½ in. by $\frac{3}{8}$ in. L steel. The second and third tiers of girders are 6 in. by 3 in. by $\frac{3}{8}$ in. T steel, with 8 in. by $\frac{3}{8}$ in. flange plates, and lattices of 2½ in. by 2 in. by $\frac{3}{8}$ in. L steel. The diagonal wind-ties are as follows: Lower bays, 5 in. by 3 in. by $\frac{9}{16}$ in. T steel; middle bays, 4 in. by 2½ in. by ½ in. T steel; and upper bays, 4 in. by 2½ in. by $\frac{7}{16}$ in. T steel.

The following table gives comparisons of the various guide framings:—

TABLE I.

—	Dia. of Outer Lifts.	No. of Standards.	Tiers of Girders.	Height of Standards.	Distance between Standards.	Sectional Area of Standard.	Weight of One Standard Exclusive of Base Plate.	Total Weight of Guide Framing.	Weight per 1000 Cubic Feet Capacity.
A.	150 ft. 0 in.	16	3	106 ft. 0 in.	29 ft. 8 in.	19½ sq. ins.	5½ tons	150 tons	1·71 cwt.
B.	205 ft. 0 in.	26	3	101 ft. 0 in.	25 ft. 3 in.	14½ ,,	5¼ ,,	256 ,,	1·71 ,,
C.	122 ft. 0 in.	14	3	94 ft. 0 in.	27 ft. 7 in.	15½ ,,	4½ ,,	118 ,,	2·36 ,,
D.	147 ft. 6 in.	18	4	108 ft. 3 in.	26 ft. 0 in.	22 ,,	9½ ,,	346 ,,	4·00 ,,
E.	150 ft. 0 in.	18	3	89 ft. 0 in.	26 ft. 5 in.	33½ ,,	9¼ ,,	280 ,,	3·73 ,,

The use of double angles for the construction of standards and girders should, as far as possible, be abandoned, owing to the liability of this form to corrosion at the junctions of the lattices. Tee steel and other sections are very efficient for this class of work, as by their use, recesses (which simply mean lodgment of water) are avoided. By the use of the latter members, the difficulty of effective painting is also overcome, as when double angles are used it is almost an impossibility for the painting to be done as it should be. Again, the use of rosettes on the lattices of girders cannot be too strongly condemned; as these, which are neither useful nor ornamental, simply mean the collection of moisture, and again the prevention of effective painting. The writer has in mind a gasholder, the girders of which are double angles, and the lattices ornamented (?) with rosettes. The condition of these girders at the present time is such that it is really unsafe for anyone to venture on to them. Some 75 per cent. of the rosettes have disappeared, and the junctions of the angle-flanges with the lattices have also for the most part failed; the the whole structure simply hanging together by the few odd rivets that are left. The contention is that if these girders had been constructed of T steel, *minus* rosettes and *plus* efficient superintendence, they would now be doing work, instead of being practically relegated to the scrap heap.

Attention should be given to the advisability of as far as possible dispensing with the cranking and welding of all members in the construction of gasholders, and substituting packings of suitable thickness. This not only to a great extent simplifies the construction, but is a cheaper method; care, of course, being taken not to overdo the matter of packings, and thus balance the question as to costs.

It is to be regretted (for reasons to be given later) that particulars of the inner lift framing of holder "A" have not yet been obtained for comparison with the others; but it may be stated that it is a trussed roof.

Passing on to holder "B," the crown of which is untrussed, the top curb is formed of an angle steel ring 6 in. by 6 in. by ½ in., with a secondary curb of 6 in. by 7½ in. by ½ in. L steel (see Diagram No. 5). The vertical stiffeners of the inner lift are 52 in number, and are lattice girders 15 inches wide, composed of double 3 in. by 3 in. by $\frac{3}{8}$ in. L steel flanges, latticed with 2$\frac{3}{8}$ in. by $\frac{3}{8}$ in. flat steel. The cups and dips are bent plates $\frac{3}{8}$ in. in thickness. The bottom curb is formed of two rings of 6 in. by 4 in. by ½ in. L steel.

Holder "C" has also an untrussed roof; the top curb being 4½ in. by 4 in. by ½ in. L steel, with a secondary curb of 5 in. by 3½ in. by ½ in. L steel. The vertical stiffeners of the inner lift are 28 in number, of 9 in. by 3¾ in. by 20 lbs. rolled steel joists. The cups and dips are formed of 9 in. by 3 in. by ½ in. ⊔ steel, with skirting plates $\frac{5}{16}$ inch in thickness. The vertical guides of the middle and outer lifts are of the usual ⊔ sections. The bottom curb in this case is made of two 4½ in. by 4 in. by ½ in. L steel rings.

Holder "D" (untrussed) has a top curb of 6 in. by 6 in. by $\frac{3}{4}$ in. L steel, stiffened by a continuous diagonal plate $\frac{3}{8}$ inch in thickness (see Diagram No. 5). This forms a circular girder of triangular section. The vertical stiffeners of the inner lift are 36 in number, of 10 in. by 5 in. by 30 lbs. rolled steel joists. The cups and dips are $\frac{7}{16}$ inch bent plates; the guides of both middle and outer lifts being 6 in. by 2½ in. by 13 lbs. ⊔ steel—36 in each case. The bottom curb is formed of two rings of 8 in. by 3 in. by ½ in. ⊔ steel, with stays (72 in number) of 9 in. by $\frac{3}{8}$ in. flat steel (see Diagram No. 5).

In holder "E" (untrussed), the top curb is formed of 5 in. by 5 in. by $\frac{5}{8}$ in. L steel, with a secondary curb of 6 in. by 3½ in.

by $\frac{5}{8}$ in. L steel. It has 36 vertical stays in the inner lift, of 8 in. by 6 in. by 35 lbs. rolled steel joists. The cups and dips are 10 in. by $3\frac{1}{2}$ in. by $\frac{7}{16}$ in. ⊔ steel, with $\frac{7}{16}$ inch skirting plates; the vertical guides of the middle and outer lifts being 36 in number in each case, and formed of 6 in. by 3 in. by $\frac{7}{16}$ in. ⊔ steel. The bottom curb is built up of two rings of 7 in. by 3 in. by $\frac{1}{2}$ in. bulb L steel.

The following table gives the thickness of the shell plates in each of the four holders. (See Table II.)

Table III. gives the capacities and weights of the various holders referred to in the course of this paper; the last holder being added so that comparison can be made with a guide-framing of rolled steel joists. (See Table III.)

From the foregoing tables of the five holders under consideration, it will be noticed that there is a variation in the total weight per 1000 cubic feet capacity of 71 per cent.; and in the guide-framing on the same basis of 134 per cent.

Special care should be taken in designing with regard to the

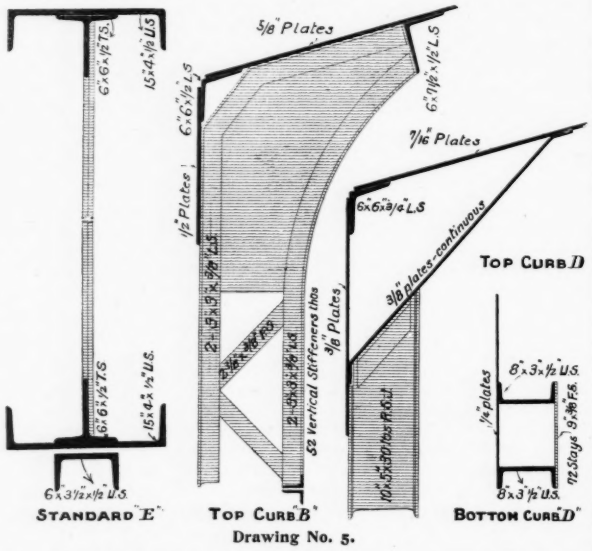
Table II.

—	Crown Sheeting.	Top Lift Sides.	Middle Lift.	Bottom Lift.
B.	$\frac{3}{8}$ in., $\frac{1}{4}$ in., 9 B.W.G.	$\frac{1}{2}$ in., 7 and 10 B.W.G.	7 and 10 B.W.G.	$\frac{3}{8}$ in., 7 and 10 B.W.G.
C.	$\frac{7}{16}$ in., $\frac{7}{16}$ in., 10 B.W.G.	$\frac{1}{4}$ in., $\frac{7}{16}$ in., 11 B.W.G.	$\frac{7}{16}$ in., 11 B.W.G.	$\frac{7}{16}$ in., 11 B.W.G.
D.	$\frac{7}{16}$ in., $\frac{7}{16}$ in., 10 B.W.G.	$\frac{3}{8}$ in., $\frac{1}{4}$ in., 10 B.W.G.	$\frac{3}{8}$ in., $\frac{1}{4}$ in., 10 B.W.G.	$\frac{1}{4}$ in., $\frac{1}{4}$ in., 10 B.W.G.
E.	$\frac{1}{2}$ in., $\frac{1}{4}$ in., 10 B.W.G.	$\frac{7}{16}$ in., $\frac{1}{4}$ in., 10 B.W.G.	$\frac{7}{16}$ in., $\frac{1}{4}$ in., 10 B.W.G.	$\frac{7}{16}$ in., $\frac{1}{4}$ in., 10 B.W.G.

Table III.

—	Capacity.	Weight of Inner Lift.	Weight of Middle Lift.	Weight of Outer Lift.	Total Weight of Three Lifts.	Weight of Guide-Framing.	Total Weight.	Weight per 1000 Cubic Feet Capacity.
		Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Cwts.
A	1,750,000	157 (trussed)	60	74	291	150	441	5·04
B	3,000,000	285	123	124	532	256	788	5·26
C	1,000,000	135	57	54	246	118	364	7·28
D	1,730,000	202	105	96	403	346	749	8·66
E	1,500,000	=	=	=	354	280	634	8·45
Holder with R.S.J. Standards 141 feet diameter by 35 feet, 28 Standards 18 in. by 7 in. by 75 lbs.	1,645,000	152½	75	80½	208	202	410	4·98

inner lifts of holders, so that this lift will be strong enough, when carrying the combined weights of the lower lifts, to resist any strains that may tend to distortion out of its true cylindrical from. This point may be considered too obvious for special reference; but it is for this reason that regret was expressed that the sections of the inner lift of holder "A" have, up to the present time, not been ascertained. It may be stated that the shell of the

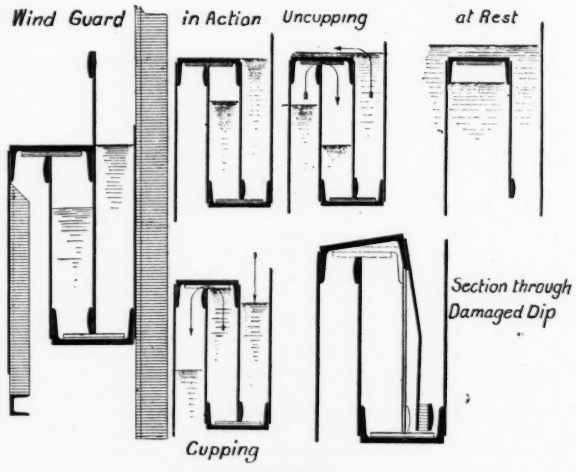


Drawing No. 5.

inner lift is formed of sheets lighter than either of the middle or outer lifts; the inner lift being No. 14 B.W.G., the middle lift 12 B.W.G., and the outer lift sheets 10 B.W.G. in thickness. When this holder is working into the lower lift, there is visible distortion of the inner lift, with the result that there is undue strain on the rivet seams. This is more noticeable in the spring or at periods of extreme climatic changes, as at these times there is a sweating through the seams, and a deposit of naphthalene frequently shows on the outer surfaces of the plates. This occurs only at the seams of the inner lift.

Special attention should also be given during the construction of holders to the adjustment of all guide-rollers, and especially so to the guide-rollers of the various cups, as these, not being very easy of access, may escape the attention that they should have. The writer has in mind a two-lift holder of 120 feet diameter where it is obvious that the cup rollers (if any) are not doing their duty. It may be possible that the upper lift never had cup rollers, or, if so, that they have, in some way, become displaced. Working this holder in the inner lift only, and during the slightest wind—and the position is a sheltered one—there is often a "rocking" of the lift of fully 12 inches. This may be an extreme case; but it points to the fact that at some time previous efficient supervision has been lacking.

Another point that is perhaps worthy of being mentioned is that, when the outer lifts are at rest, the dips of the same should not be totally immersed in the water of the tank. A holder constructed on these lines is shown on Diagram No. 6. which gives the position of the outer lifts when at rest; the direct result, in this case, being a damaged dip as shown on the same diagram. The dip-channel, as shown on the diagram, is "sprung" about 10 feet in length around its circumference. The skirting plates are buckled to an extent of about 4 or 5 feet; the bead being torn away from the plates about the same length, and lying in the cup, as shown. The present position of the bead is such that the face of the same is rubbing over the rivet heads of the inner-lift shell. The diagram shows, as near as can be ascertained, the cross section through the cup, at the point where the damage is greatest, and as it stands at the present time. This is attributed to the fact that when the holder is in the act of uncupping, the gas contained in the dip of the outer lift becomes compressed as the holder falls; and this pressure, acting upon the surface of the water in the cup between the skirting plates, forces the water up between the dip-plates and the inner lift shell until it overflows over the dip-channel. In the case under notice, the dip-plates very often become unsealed, and the gas under the dip escapes until the dip-plates are further immersed in the water of the tank.



Drawing No. 6.

The reverse effect takes place when the holder is being cupped as, on the holder rising, a partial vacuum is formed in the space immediately under the dip, and this, combined with the atmospheric pressure exerted on the surface of the water between the inner lift shell and the dip plates, causes the water to flow up between the skirting plates and over into the tank, until the cup-channel is clear of the water line, when the dip becomes filled with gas, and the water in the cup assumes its normal position.

It is during these changes (as shown on Diagram No. 6) that if

there is a piece of wood or other substance floating in the tank, it is brought down into the cup, and probably becomes wedged between the cup-channel and the dip-skirting plates, and the holder continuing to rise, uneven straining takes place. This, I believe, was the main cause of the damaged dip shown; the dip channel in this case failing at a joint.

It may be said that this piece of wood should not have been in the tank. This is at once granted; but it only goes to prove that it is not always the expected that happens.

It has often been noticed, especially with holders in exposed positions, that there frequently occurs a displacement of the water in the cups, owing to sudden gusts of wind sweeping round the holder, and carrying the water in the cups with it, until there is overflowing, and, in extreme cases, the possibility of the seal being reduced to a somewhat dangerous extent. This can be overcome by the use of "windguards." A very simple—and at the time of constructing a holder, quite an inexpensive—method is shown on Diagram No. 6. This consists of carrying the dip-plates above the channel to any desired extent.

The preservation of structural steelwork in gas-works is of the utmost importance, and should not at any time be neglected. Dealing with new work, opinions vary as to its treatment. One prominent engineer says that "new ironwork should be painted with red lead or with boiled oil before any rust has formed, on the contractor's premises." An extract from a Railway Company's specification for bridge work reads—

> The iron and steelwork is *not* to be painted nor dipped in oil at the makers' works, except when the girders are put together, and then the whole of the surfaces in contact shall, before they are placed together, receive one coat of approved paint. When the bridges are completed and sufficient time has elapsed to allow the mill scale to drop off, the girders are to be well scraped and brushed with wire brushes, and when clear from rust and dust, the whole of the surfaces shall receive four coats of the same paint; each coat to vary in colour, and to be left of an approved colour. Any painting damaged during the term of maintenance shall receive one additional coat or more if ordered by the engineer.

The writer is inclined to support the latter opinion, as the prevention of damage to the mill-scale is so very difficult, if not impossible, that the best thing seems to be to allow it to form freely, and then clear the surface of the work once and for all from any rust. As to the mill-scale being kept perfectly intact upon the steel, and so being in itself a good protection, this cannot practically be done, as in the punching of the plates, &c., the scale is broken. It has also been explained by previous writers on the subject that magnetic oxide of iron in close contact with metallic iron forms a galvanic couple; and the oxide being the positive element, the iron would corrode. This action also seems to continue underneath paint; so that all rust should be entirely removed. The use of red lead as a preservative has been given serious attention of late, and is very highly spoken of; but the writer is not in a position to state any results of the extended use of the same personally. Mention is, however, made here of its value, so that anyone interested can deal with the question to meet his own particular case.

In connection with the matter under consideration, one question has forced itself to notice—*i.e.*, "Is the average gas-works manager or superintendent, fully alive to the responsibility that rests upon him as to the care of the structures under his charge?" In many cases, the answer would have to be in the negative. A case in point: "A retort-house that was erected about twenty-four years ago, the roof principals of which, up to quite a recent date, had never even been examined nor once cleared of their accumulation of dust." It is not within the scope of this paper, even had the writer been at the time of writing in a position to do so, to give in detail the result of the overhauling; but no doubt many useful hints would be derived as to the future erection of such roofs that are liable to be so neglected.

When painting roofwork, special care should be taken to see that the junctions of the members get their proper share of attention, as it often happens that the members themselves receive an adequate amount of paint, but, owing to a little difficulty presenting itself to the man with the brush as to the positions of the junctions, these vital portions of the roof framing are, if careful supervision is not given, more often than not passed with but scant regard to their future wellbeing; and the life of the whole structure is thus endangered.

To give another example of the want of thought and care: Two tower scrubbers had at one time both been in use with ammoniacal liquor. This in both cases was introduced into the top of the scrubbers; but one supply was "closed" and the other "open." The result is that to-day the machinery house on the "open" supply scrubber is in a very dilapidated and dangerous condition; while the other one is likely to stand good for many years to come.

Very careful and thoughtful supervision then is necessary, having regard to the life of all structural steel and ironwork; and the writer is of opinion that systematic investigation should be insisted upon, and all work of this nature carefully examined every year, and then any necessary painting and overhauling carried out immediately. It is only by close attention to these details that the preservation of structural steelwork can be successful; and it behoves all works' managers and superintendents, or those directly responsible for the upkeep of their various plant, to give this, as well as all other questions, their serious consideration.

Discussion.

The PRESIDENT (Mr. M. Leaf, of York) said he was sure the members would all regard Mr. Nelson's paper as a very valuable contribution to the Transactions of the Association. The subject was a very interesting one, especially to those who were contemplating the erection of a gasholder.

Mr. A. C. HOVEY (Tynemouth) remarked that Mr. Nelson had pointed out a very great divergency in the various sections of gasholder work, especially in the guide-framing. There was doubtless considerable variation in the margin of safety allowed; but this point had not been mentioned. Perhaps Mr. Nelson might give some figures relative to it. If the sections of steel were properly disposed—the materials were naturally the same in quality—the heavier the material the stronger would be the structure; but, of course, to put good material in the wrong place was to be condemned. A holder came under his notice some time ago, where certain parts of the guide-framing were less than ¼ inch thick; and he would not care to be responsible for this holder if it ever came to be exposed to a strong gale of wind. Mr. Nelson's remarks were particularly applicable to the preservation of such a holder, by painting from time to time—in fact, painting should be almost a constant piece of work; and if this were neglected, probably the results would be most disastrous. It did not follow that because a gasholder was lightly built, it was inexpensive. His remarks were, to some extent, brought forward owing to his recognition of one of the holders mentioned—that referred to as "E"—with the designing of which he had been intimately connected. The guide-framing of this holder was mentioned as being the heaviest of those given; but if they referred to the figures in the last table, they would notice that the holder "D" was really the heavier of the two (in the last column) in the weight per 1000 cubic feet of storage. The cost of the holder "E," so far as the steelwork was concerned, amounted to £6 2s. per 1000 feet of gas stored. The cheapest holder, he believed, that was ever constructed came to £5 per 1000 cubic feet—a reduction of about 20 per cent.; but he was not able to give any figures regarding the various margins of safety allowed in any particular holder. The weight of the holder being doubled, it did not follow that the cost was doubled. The cost of the holder marked "E" was less than £15 per ton. He thought the effect of anyone proceeding to design a holder, after seeing the figures put before them, would be—especially when the upkeep was taken into account—that he would make one somewhat on the lines of the heavier sections. There were a great many points in connection with the design of a holder which affected its weight considerably; and he would mention some that might sometimes be overlooked. For instance, there were the variations in temperature, which set up strains in the structure. Then there were also the stresses which arose in the action of the various parts of the guide-framing; and so forth. It was very proper that the top curb of the inner lift should take some of the strain, in maintaining the holder cylindrical, and preventing distortion. The cost of a holder depended upon the details of design, the margin of safety, local conditions, and markets. Certainly, the figures placed before the members tended to standardization, which was very much to the front nowadays; but to make a standard gasholder would be nearly as difficult as to construct a standard retort-setting. Everyone had his own ideas, and would be controlled by his previous experiences and by local conditions.

Mr. C. DRU DRURY (Sunderland) said he should like to add his testimony in favour of the use of red-lead paint. They had at Sunderland four gasholders which had for years been painted with oxide, and which had always presented a very nice appearance; and this paint kept them efficient. In one of the holders, which he thought was erected in 1861, he noticed a perfect network of cracks, which further coats of paint did not fill up but simply aggravated. Last year, therefore, he decided that it would be advisable to chip or scrape off the whole of the paint from the holder, which was 120 feet in diameter. They did so; but it entailed a great deal of trouble and cost a lot of money. They found, at the bottom of all, the original coat of red-lead paint, which had been put on at the time the holder was erected. In many places it was impossible to remove it; but where they did so, they found that the sheets were as clean as the day they were erected, and they came upon the white lead numbering put on during the process of erection. So that it appeared to him that, for iron and steel work, a first coat of red-lead paint was very difficult to beat. Of course, the subsequent coats might be anything one chose; and oxide paint resisted probably better than anything else the gases and acids found in gas-works. His practice for a number of years had been always to employ oxide paint ready mixed for use. They previously mixed it themselves, and painted their holders once a year. Now he found that, with the material ready prepared, they could paint them every alternate year, and wash them intermediate years. He agreed that with steelwork it was of the greatest interest to preserve it in every way, as it formed their really most expensive item. This pointed to the desirability of using, as far as possible, reinforced concrete in place of steel, because its upkeep cost practically nothing after it had been erected.

Mr. J. HOLLIDAY (Hull) remarked that the whole tenor of the paper came to what Mr. Hovey referred to as standard rates. The number of types and designs of gasholders pointed to the necessity for getting matters under more uniform conditions than they were at the present time. Personality came in very largely, perhaps, in

gasholder construction. One man liked to see a heavy holder; while another preferred a graceful type of guide-framing. He had in his mind a holder, the shell of which was made stable entirely by the weight of the columns. On the other side of the road there was one which was, on the whole, like a spider's web. The weight of the columns in the first was the only thing which gave the holder stability, in rising, in face of the wind pressure against it. In the second case, the intention had evidently been to spread it over the circumference of the holder, without any regard to weight. The point which struck him most, in the latter part of the paper, was the author's remark about the use of double angles—that they should be abandoned owing to their liability to corrode at the junctions of the lattices. This was, as they all knew, a very weak point where double angles were employed. Then, with regard to rosettes, their use ought to be—adopting a familar expression—as dead as a door-nail, because they were of no practical use, and they simply tended to cause accumulation of moisture or of the rain water running down the wind-ties. The holder "A" seemed to be rather a remarkable type in the thickness of the sheets. The author stated that the shell of the inner lift was formed of sheets lighter than either of the middle or the outer lift, with the result that there was visible distortion of the inner lift and undue strain on the rivet seams. With this form of construction, it seemed impossible that anything else should happen. With regard to painting, the old-fashioned clause in specifications, that all ironwork was to receive a coat of paint before leaving the contractors' works, was surely one they ought now to dispense with, especially in reference to the explanation given in the paper as to the mill-scale. Painting at the contractors' works simply meant putting a coat on, which was sure to come off again sooner or later. As to the painting of retort-house ironwork, he noticed that the author spoke of a case of 24 years' standing; and the curious thing was that the joints of the sections were as good now as they were when they were put up. There had been some natural protection, formed by the fine dust in the retort-house and the moisture. He did not suppose it would happen more than once in a hundred times; but there the fact stood.

The President called attention to the fact that Mr. Charles Wood, the President of the Institution of Gas Engineers, was present; and he invited him to take part in the proceedings.

Mr. C. Wood (Bradford), responding to the invitation, said he was much obliged for the President's kindly welcome to the meeting, which he thought was the first gathering of the North of England Association he had had the opportunity of attending. He was sorry he could not say very much about the paper. Comparisons of gasholders, like comparisons of any other engineering work, were difficult to make. Unless they knew more about the details of the various holders, and the conditions under which they were working, they could scarcely discuss the paper. With reference to the preservation of ironwork, especially gasholders, he had had a little experience, and had made some very interesting experiments on them. He was entirely in accord with Mr. Drury in thinking that red lead was by far the best paint to put on a holder, whether of steel or iron, for the first coat; but he did not agree with the last speaker, or with the author of the paper, in suggesting that iron or steel work—especially the latter—should never be painted before it left the contractors' works, for the reason that he had found that when rust was once formed, particularly on steel, it was practically impossible to remove it. In Bradford, they had nineteen different gasholders of various styles of engineering architecture. They had one of which the upper lift had been in use for more than fifty years. Of course, it was not steel. The iron was to-day, or, at any rate, it was about two years ago, in as good condition as when it was first erected. As far as he had been able to discover, this ironwork was of good quality. To begin with, it was covered with several coats of red-lead paint. If they once got their steelwork coated with good paint of this kind before rust had had time to form, he did not think it mattered much whether they put oxide or lead paint, or even tar varnish, on the top of it. But when they had once got rust on gasholder sheeting, he knew of no method by which they could get it thoroughly removed. They had, in experimental work, been to the trouble of using the sand blast on a small piece of sheeting; and even then, after two year's exposure to atmospheric influences, they found corrosion taking place. He thought there could not be two opinions as to the disadvantages of double angles and rosettes. To members who might have gasholders with rosettes on them, he would suggest that they should remove them at the earliest opportunity. With double angles he would, as far as possible, fill up all the interstices with pitch. He had done all his with pitch, to avoid the accumulation of moisture. He was much impressed with the great importance of having the dips of the holders above the level of the water in the tank. They had an accident to one of their gasholders at Bradford, which might have been a very serious one, arising just in the way Mr. Nelson had mentioned.

Mr. Nelson thanked the members very heartily for the kind way in which they had received his paper, especially as during its preparation he was rather afraid that, owing to the necessity of having to take the form somewhat of specifications, it would prove very dry reading. With regard to Mr. Hovey's remarks as to the strains on these structures, it was not his intention, nor did he think there was room in the paper, to deal with strains. If anyone were desirous of doing this, he could work them out for himself. Mr. Hovey pointed out discrepancies as between holders "D" and "E"; and he (Mr. Nelson) quite agreed that the standards of "E" were very much to be preferred to those of "D." The weight of the standards of "D" was made up mostly of the heavy junctions between the standards and the girders. They were frightfully heavy. In comparing the two standards themselves, those of "D," it must be noticed, were slightly higher than those of "E," which would make up a little for that. He was very pleased to hear Mr. Drury's remarks upon red-lead paint, because his own experience had not been a very lengthy one in regard to it. Mr. Holliday had mentioned the use of double angles in connection with corrosion; and he (Mr. Nelson) quite agreed with him in all he said. He had also remarked that the use of rosettes was now dead. Well, they should be if they were not; but it was only about six months ago that a holder was brought to his notice which was not originally designed to have rosettes, but the engineer specially asked to have them placed on it. Evidently, some people thought they added to the appearance of the holder.

The Spontaneous Oxidation of Coal.

In the course of a paper read by Herr Habermann, of Greifswald, before the last meeting of the Baltic Association of Gas and Water Engineers, the author described some experiments he had carried out upon the spontaneous oxidation of coal. After mentioning the various conditions in which coal is prone to exhibit self-heating phenomena—among them being chiefly a state of fine subdivision in the coal and an exposure to a slightly elevated temperature—Herr Habermann went on to give the results of his own investigations. He charged with powered coal an empty retort in a setting out of use which was uniformly and permanently warmed by heat conducted from the contiguous settings. He fitted an inlet-tube for the air and a measuring apparatus, closing up the ordinary charging-door, and opening the cover of the ascension-pipe. He then found that the original temperature of 140° C. gradually rose to one of about 350° C.; the velocity of the increase in temperature and the actual maximum attained being greater when the coal was Leverson's Wallsend than when the charge consisted of "Bighwine" coal. The cause of this spontaneous oxidation depends on the power of a coal to absorb oxygen. Coals behave towards bromide in a very similar way to that in which they behave towards oxygen; so that it appears that their reaction with bromine may be employed as a means of judging how they are likely to behave when exposed to atmospheric oxygen. It is frequently stated that freshly-won coal tends to oxidize spontaneously with more energy than older lots of the same kind; but Herr Habermann's experiments do not support this view.

The New Council of the Institution of Civil Engineers.

At the Annual General Meeting of the Institution last Tuesday, the result of the ballot for the election of officers for the ensuing year was declared. Sir Alexander B. W. Kennedy, LL.D., F.R.S., succeeds Sir Alexander Binnie as President; and the Vice-Presidents are Mr. W. R. Galbraith, Mr. W. Matthews, Sir E. Leader Williams, and Mr. J. C. Inglis. Among the members of Council are Dr. G. F. Deacon, Mr. Maurice Fitzmaurice, Mr. G. H. Hill, Mr. Walter Hunter, Sir George Livesey, the Hon. C. A. Parsons, Mr. A. Siemens, Sir John I. Thornycroft, and Professor Unwin, all of whom are associated with undertakings in which our readers are interested. It is specially gratifying to us to record the accession to the Council of Sir George Livesey, whose membership of the Institution extends over 34 years. We believe the Council have for a long time desired to have among them a representative of the gas section of the engineering profession; but, owing to the comparatively small proportion of gas engineers among the corporate members, this has not been secured in consequence of the insufficiency of votes. We congratulate the new Member of Council on his election, and the Institution on their choice of so very representative and distinguished a leader in what is regarded by those engaged in it—and justifiably, as we venture to think—as a most important field of engineering. The event ought not to fail to give encouragement to the younger men to qualify for the highest position, and to follow the true professional lines in their endeavours to attain it. In another respect the gas industry is represented upon the new Council; for though Mr. Walter Hunter is professionally a water engineer, he is Deputy-Chairman of the Commercial Gas Company. Other representatives of water engineering are Dr. Deacon and Mr. Hill, whose connection with the water undertakings of Liverpool and Manchester is well known to most of our readers.

Society of Engineers.—At the meeting of the Society next Monday, a paper on "The Chemistry and Bacteriology of Potable Waters" will be read by Dr. David Sommerville, B.A., Lecturer in Public Health at King's College. The author will first of all refer to the sources of water, and then deal with its examination, discussing the comparative values of chemistry and bacteriology in carrying on the operation. The different systems of filtration will next be considered, and the efficacy of the sand method emphasized; and the paper will conclude with some remarks on water-borne disease.

EXTRACTS FROM A PHOTOMETRIST'S NOTEBOOK.

By James Foreman.

[A Paper read before the North of England Gas Managers' Association, April 28.]

I hasten to assure you that this paper is literally what its title purports—namely, "Extracts from my Notebook." And the fact that it is a photometrist's notebook by no means limits its pages to dry records of uninteresting details. I find that, by skipping pages and taking things out of their order, I am able to collate some useful comparative figures of different forms of lighting, which will be of more immediate interest to you than miscellaneous records. And it is this bare unbiassed record of dry facts that I want to present to your notice in detail to-day.

The facts and figures which I to-day present I have selected because I think they may be regarded as average examples of types of current interest; and in order to make them the more instructive I have, as you will see, dealt with them as two classes —viz., electric lamps and gas lamps; and for basis of comparison I take gas at 2s. 6d. per 1000 cubic feet, and electric current at 4d. per Board of Trade unit (1000 watts).

I wish, as a preliminary, to make one general remark, and it is this—that I do not put these figures before you as representing the "highest possibles," but simply as results that I have actually obtained myself when examining each type separately, with a view to arriving at a true result under each set of circumstances. I wish to emphasize this because it is very possible that some of you may have failed to get such results in some cases, and have got much better results in others. These figures are what I have obtained from the specimens submitted to my tests, and I give them for what they are worth. Certainly I think they can be taken as good general guides as to practical efficiencies.

The first lamp I come to is a type you are all familiar with. It is a No. 4 Welsbach "Kern" burner in a 16-inch copper lantern of the usual type as fixed in the street. The full results of this test, as with all the others mentioned, are set out in the tables. The salient features will be seen to be that, with a pressure of 2·3 inches and a consumption of 5·17 cubic feet of gas, an illuminating power of from 126 candles in the horizontal to 35·2 candles at 80° was obtained—giving a mean hemispherical candle power of 96·998, and a yield on this mean of 18·76 candles per foot—costing for gas per 1000 candle-hours the sum of 1·599d.

I have mentioned "mean hemispherical candle power," and should like to say here what is meant by the term. I need not trouble you with the formulæ and method for arriving at it; but the expression may be explained by imagining a light enclosed in a translucent hemisphere set at a radius of 1 foot from the source of light. If, for example, the Kern burner above were taken as the source, the light in one direction would be 126 candles, in another direction, 35·2 candles, and in yet another, 0. But one may imagine the mean hemispherical candle power as though the cross reflections of the hemisphere effects a general levelling-up; so that the light on any spot of this hemisphere 1 foot distant from this particular source is 96·998 candles. This explanation, or rather illustration, will suffice to make clear the reference to mean hemispherical candle power which is taken as the basis of comparison right through the tests of the various types. It is, of course, necessary to use some such method; otherwise it is difficult to compare different types, in some of which there is no light downward, and in others very little light in any other than a downward direction, and again in others where the bulk of the light is thrown in a limited area at a few angles.

I should have liked my next extract to be of an electric lamp of about the same candle power as the Welsbach "Kern" burner cited above. But, as you know, most electric street-lamps are large units of power; so I content myself with drawing your attention to the figures for a Nernst "Luna" lamp. This was with a clear globe, new filament, 200-volt by 1 ampère nominal. A consumption of 198·7 watts gave a light of from 96 candles in the horizontal, to 277 candles directly underneath—giving a mean hemispherical candle power of 152·856, a duty of 0·769 candle per watt, and a cost for 1000 candle-hours of 5·16d., as compared with 1·599d. for the Kern. The same lamp, run 200 hours, dropped in efficiency and increased in cost to 5·88d. for 1000 candle-hours.

Having illustrated how extremes meet, I may now, I think, draw attention to the remaining tests in groups, commencing with a few arc lamps. But before doing so—in order to give you an intelligent basis of comparison with the figures I have already given and those I am about to give—I should like to say that the cost of 1000 candle-hours with an ordinary electric filament lamp is about 1s. 2d., and of an ordinary gas argand about 1s.; so you will see how very efficient the types of lamps are when the 1000 candles for one hour cost from ¾d. to 2d., and in no case more than 6d.

A splendid efficiency in relation to current consumption is to be got from a flame arc. One I tested (an 8-ampère nominal) gave with a consumption of 382 watts and a pressure of 44 volts—a mean hemispherical candle power of 1342 candles—showing an efficiency of 3·51 candles per watt, and a cost for 1000 candle-hours of 1·14d.

But compare this with an enclosed arc I tested—a 6-ampère lamp it was—running at 77·6 volts, with no outer globe. This with 485 watts only gave 329·17 candles, showing a duty of 0·678 candle per watt, and a cost for 1000 candle-hours of 5·88d.

Another enclosed arc was much better. It was a 5-ampère lamp, running at 83 volts. This with a consumption of 423 watts gave a mean hemispherical candle power of 658·67 candles, an efficiency of 1·55 candles per watt, and a cost for 1000 candle-hours of 2·568d.

A 10-ampère open arc with an alabastrine globe running at 40·56 volts gave with a consumption of 430 watts a mean hemispherical candle power of 770·27, a duty of 1·79 candles per watt, and a cost for 1000 candle-hours of 2·224d.

The efficiency of this is very much better than of a miniature arc—one of those small arc lamps with a violet ray. The particular specimen I am thinking of was a 2-ampère nominal lamp and was tested with an 8-inch shade, just as it is supplied. With a pressure of 85·25 volts, a consumption of 191·8 watts, it yielded a mean hemispherical candle power of 161·467, showing an efficiency of only 0·842 candle per watt, and a cost of 4·72d. for 1000 candle-hours.

These are a few typical examples of electric lamps, and you will see how the efficiency varies and how the newly-introduced flame arcs get very much nearer the level as regards actual consumption cost, of the various incandescent gas types which I am now going to draw your attention to.

Dealing first with those which require auxiliary pressure apparatus, the cost for the gas only on tests I made works out as follows.

A Keith high-power burner in a 20-inch lantern, just as sold, ready for use, running at a pressure of 8 inches, consumed 10·2 cubic feet per hour, giving a mean hemispherical candle power of 269·942 candles, which shows a very good yield of 26·46 candles per foot and a cost for 1000 candle-hours of 1·13d.

A Keith high-power workshop light, with a reflector, sold as a 300-candle power nominal, running at a pressure of 8 inches, consumed 9·27 cubic feet per hour; and this gave a light varying from 315-candle power down to 225 candles, showing a mean hemispherical candle power of 275·307, a duty in candles per foot of 29·69, and a cost for 1000 candle-hours of 1·01d.

A Welsbach high-power burner suspended in a harp pendant was run at 8 inches pressure, consumed 10·7 cubic feet, gave a light varying from 348 candles downwards, showing a mean hemispherical candle power of 231·708, a duty of 21·65 candles per foot, and a cost of 1·383d. for 1000 candle-hours.

A Sugg high power burner suspended in a harp pendant, running at 7 inches pressure, consumed 10·8 cubic feet, gave a mean hemispherical candle power of 166·479, a duty of 15·41 candles per foot, and a cost for 1000 candle-hours of 1·94d.

Both these burners would, of course, give a higher mean hemispherical candle power if they were mounted in lanterns or surmounted by a reflector, so as to concentrate light downwards —that is to say in the direction in which the useful light is required.

A Scott-Snell lantern, just as sold, running at a pressure of 1·6 inches, consumed 17·5 cubic feet per hour, giving a mean hemispherical candle power of 560 candles, a duty of 32 candles per foot, and a cost of only 0·9375d. for 1000 candle-hours.

A Welsbach self-intensifying lamp, sold with a reflector as 600-candle power nominal, running at 2·8 inches pressure gave a light varying from 615 candles, a mean hemispherical candle power of 452, a duty of 23·8 candles per foot, and a cost for 1000 candle-hours of 1·26d. I made an experiment with the same lamp with the reflector removed. This reduced the mean hemispherical candle power to 396·76, and increased the cost to 1·41d. for 1000 candle-hours.

A Lucas lamp of the 20 feet per hour pattern, run at 3 inches pressure, gave a mean hemispherical candle power of 522·3, a duty of 22·21 candles per foot, and at a cost of 1·35d. for 1000 candle-hours.

It should be noted (and inwardly digested by all gas managers) that the duty of these self-intensifying burners drops off if the pressure is low and increases very rapidly if the pressure is anything from 2½ to 4 inches. I mean that although, of course, the increase of pressure means a slight increase of consumption, the illuminating power advances out of proportion to the increase in consumption, and thus the duty is high.

I can now draw your attention to a couple of tests, selected from a large number, upon the ordinary Welsbach "C" burner. A "C" burner at 18-10ths pressure, and consuming 3·5 cubic feet per hour yielded a mean hemispherical intensity of 56·648 candles (the light in horizontal direction being 77 candles), and a duty on the mean hemisphere of 16·2 candles per foot; so that 1000 candles for one hour cost 1·85d.

Of course, a lot of the light of an ordinary Welsbach burner is in an upward direction, and is utilized by reflection from the walls and ceiling; but in a photometrical test of hemispherical intensity, this useful upward light is not shown on the photometer. I, therefore, selected a test of the same burner tested under the same conditions, but fitted with a "Comet" shade of the usual pattern. This increased the hemispherical intensity to 62·52 candles and the duty to 17·86 candles per foot, reducing the cost to 1·68d. for 1000 candle-hours.

TABLE I.—*Electric Lamps.*

Description.	Flame Arc with Alabastrine Globe. Carbons 9 mm. and 8 mm. 8 Ampères Nominal.	Open Arc with Alabastrine Globe. Carbons 18 mm. and 12 mm. 10 Ampères Nominal.	Enclosed Arc with Clear Inner and no Outer Globe. Carbons 13 mm. 5 Ampères Nominal.	Enclosed Arc with Alabastrine Inner and no Outer Globe. Carbons 13 mm. 6 Ampères Nominal.	Miniature Arc with 8-Inch Shade. Carbons 5 mm. 2 Ampères Nominal.	Nernst "Luna" Lamp with Clear Globe and New Filament. 200 Volts × 1 Ampère Nominal.	Nernst "Luna" Lamp without Globe, after Several Days' Running. 200 Volts × 1 Ampère Nominal.
Mean current ampères	8·7	10·60	5·1	6·25	2·25	..	..
Mean pressure in arc, volts	44·0	40·56	83·0	77·60	85·25	..	..
Mean consumption in watts (shunt included)	382·0	430·00	423·0	485·00	191·80	198·7	201·0
Details of Candle Power.						The figures for each angle are the mean of tests with the filament at different angles.	The figures for each angle are the mean of tests with the filament at different angles.
Horizontal.	600 0	348·0	432·0	306·0	Horizontal 82·53	Horizontal 96·0	Horizontal 94·0
10° S.	760·0	481·0	450·0	294·0	22½° S. 187·64	15° S. 122·0	15° S. 120·0
20° S.	1120·0	888·0	460·0	340·0	45° S. 181·02	30° S. 155·0	30° S. 132·0
30° S.	1520·0	1120·0	1180·0	338·0	67½° S. 164 18	45° S. 182·0	45° S, 150·0
40° S.	1830·0	1270·0	990·0	369·0	90° S. 149·25	60° S. 188·0	60° S. 171·0
50° S.	1750·0	1120·0	775·0	411·0		75° S. 198·0	75° S. 189·0
60° S.	1700·0	450·0	680·0	361·0		90° S. 277·0	90° S. 181·0
70° S.	1680·0	48·0	116·0	244·0			
80° S.	1560·0	14·3	45·0	54·5			
90° S.	1000·0	0·0	50·0	32·5			
Mean hemispherical candle power	1342·0	770·27	658 67	329·170	161 467	152·856	136·226
Candles per watt (on mean hemispherical candle power).	3·51	1·79	1·55	0·678	0·842	0·769	0·677
Cost of current only for 1000 candles for 1 hour. Current at 4d. per unit (1000 watts)	**1·14d.**	**2·224d.**	**2·568d.**	**5·88d.**	**4·72d.**	**5·16d.**	**5·88d.**

TABLE II.—*High-Power Gas-Lamps requiring Auxiliary Pressure Apparatus.*

TABLE III.—*Self-Intensifying Gas-Lamps requiring no Auxiliary Pressure Apparatus.*

Description.	Keith H.P. Burner with 20-Inch Lantern as Sold ready for Use.	Keith H.P. Workshop Light with Reflector as Sold. 300 C.P. Nominal.	Sugg H.P. Burner Suspended in Harp Pendant.	Welsbach H.P. Burner Suspended in Harp Pendant.	Scott-Snell Lantern with Solid Bottom as Sold.	Welsbach Self-Intensifying with Clear Globe and Reflector. Sold as the 600 C.P. Nominal Suspension Lamp.	Welsbach Self-Intensifying 600 C.P. Lamp, but with Reflector Removed.	Lucas Lamp (Suspension), 20 Cubic Feet per Hour Pattern.
Data as to Quality of Gas, &c.. Barometer	29 7 inches	29·7 inches	29·5 inches	29·5 inches	29·5 inches	29·8 inches	29 8 inches	29·7 inches
Thermometer	61° Fahr.	61° Fahr.	55° Fahr.	60° Fahr.	60° Fahr.	59° Fahr.	59° Fahr.	56° Fahr.
Quality (16-candle flame value)	16·41 candles	16·41 candles	16·77 candles	16·27 candles	16·53 candles	16·08 candles	16·08 candles	16·1 candles
Calorific power (gross)	616 B.Th.U.	616 B.Th.U.	610 B.Th.U.	610 B.Th.U.	616 B.Th.U.	608 B.Th.U.	608 B.Th.U.	620 B.Th.U.
Pressure in inches of water	8·0	8·00	7·0	8 0	1·6	2·8	2·8	3·0
Corrected gas consumption in cubic feet per hour	10·2	9·27	10·8	10 7	17·5	19·0	19·0	23·5
Details of Candle Power.								
Horizontal.	361·0	255·0	223·7	348·0	718·0	615·0	621·0	750·0
10° S.	295·0	300·0	190·0	298·0	647·0	575·0	585·0	715·0
20° S.	282·0	297·0	204·0	275·0	678·0	543·6	483·0	660·0
30° S.	297·0	315·0	199·0	250·0	612·0	473·0	468·0	548·0
40° S.	232·0	255·0	180·0	230·0	538·0	420·0	380·0	505·0
50° S.	202·0	254·0	142·0	170·0	497·0	360·0	250·0	416·0
60° S.	180·0	232·0	94·0	130·0	397·0	280·0	104·0	256·0
70° S.	181·0	225·0	58·0	82·5	335·0	210·0	43·0	104·0
80° S.	94·0	277·0	5·25	53·0	0·0	190·0	33·1	36·5
90° S.	105·0	302·0	0·0	0·0	0·0	175·0	5·7	28·0
Mean hemispherical candle power	269·942	275·307	166·479	231·708	560·0	452·0	396·767	522·30
Candles per cubic foot (on mean hemispherical candle power)	26·46	29·69	15·41	21·65	32·0	23·8	20·880	22·21
Cost of gas only for 1000 candles for 1 hour. Gas at 2s. 6d. per 1000 cubic feet	**1·13d.**	**1·01d.**	**1·94d.**	**1·383d.**	**0·9375d.**	**1·26d.**	**1·41d.**	**1·35d.**

The next two tests are of a four-cluster lamp, indoor, known as the Humphrey. With the globe and reflector as sold, at a pressure of 2·7 inches, the consumption was 21·8 cubic feet per hour, the mean hemispherical candle power 316·807, duty 14·53 candles per foot, and the cost 2·064d. for 1000 candle-hours. As an experiment, I removed the globe and reflector, and then the mean hemispherical candle power decreased by 4 candles, and the cost for 1000 candle-hours was slightly more—*i.e.*, 2·088d.

The remaining lamps of my tests, to which I should like to draw your attention, are one or two inverted burners.

One of the "Globe" inverted burners, which may be taken as a fair example of the "all-metal" type, at a pressure of 1·7 inches, consuming 3·7 cubic feet per hour, gave a mean hemispherical candle power of 58·66 candles, a duty of 15·8 candles per foot, and a cost of 1·89d. for 1000 candle-hours.

A "New Inverted" burner with porcelain reflector (bijou), at a pressure of 2·3 inches, consumed 1·2 cubic feet per hour, gave a mean hemispherical candle power of 19·104, showing a duty of nearly 16 candles per foot, and a cost for 1000 candle-hours of 1·88d.

A larger pattern "New Inverted" burner, with a consumption of 3·2 cubic feet per hour, and a mean hemispherical candle power of 54·032, gave a duty of 16·88 candles per foot, and cost of 1·77d. for 1000 candle-hours.

A Welsbach Kern inverted burner is the last test I put before you; and this, with a pressure of 2·1 inches consumed 2·76 cubic feet per hour, gave a mean hemispherical candle power of 58·582 candles, a duty of 21·2 candles per foot, and cost for 1000 candle-hours only 1·41d.

All these inverted burners were tested with their globes. I

TABLE IV.—*Incandescent Gas-Lamps (Single and Clusters).*

Description.	Welsbach No. 4 Kern Burner in 16-Inch Square Lantern of the Usual Type.	Welsbach "C" Burner with Jena Chimney.	Welsbach "C" Burner, but with Comet (Opal) Shade.	Humphrey Four-Cluster Indoor Suspension Lamp, with Globe and Reflector as Sold	Humphrey Four-Cluster Suspension Lamp, with Globe and Reflector Removed.
Data as to Quality of Gas, &c.: Barometer	29·5 inches.	29·5 inches.	29·5 inches.	29·8 inches.	29·8 inches.
Thermometer	60° Fahr.	60° Fahr.	60° Fahr.	59° Fahr.	59° Fahr.
Quality (16-candle flame value)	16·27 candles.	16·27 candles.	16·27 candles.	16·08	16·08
Calorific power (gross)	610 B.T.U.	610 B.T.U.	610 B.T.U.	608 B.T.U.	608 B.T.U.
Pressure in inches of water	2·3	1·8	1·8	2·7	2·7
Corrected gas consumption in cubic feet per hour	5·17	3·5	3·5	21·8	21·8
Details of Candle Power. Horizontal.	126·0	Horizontal 77 0	Horizontal 47·0	430·0	472·5
10° S.	122·0	22½° S. 66·7	22½° S. 75·0	337·0	415·0
20° S.	98·5	45° S. 50·7	45° S. 76·0	337·0	327·0
30° S.	101·0	67½° S. 17·4	67½° S. 37·0	354·0	350·0
40° S.	98·0	90° S. 0 0	90° S. 0·0	361·0	291·0
50° S.	88·5			278·0	266·0
60° S.	73·0			199·5	195·0
70° S.	55·0			166·0	117·0
80° S.	35·2			189·0	56·1
90° S.	0·0			146·0	27·8
Mean hemispherical candle power	96·998	56·648	62·52	316·807	312·838
Candles per cubic foot (on mean hemispherical candle power)	18·760	16·200	17·86	14·530	14·350
Cost of gas only for 1000 candles for 1 hour. Gas at 2s. 6d. per 1000 cubic feet	**1·599d.**	**1·85d.**	**1·68d.**	**2·064d.**	**2·088d.**

TABLE V.—*Inverted Incandescent Burners.*

Description.	"Globe" (all Metal) Inverted Burner with Plain Globe.	New Inverted "Bijou" Burner (Porcelain Deflector) with Plain Globe.	New Inverted Burner (Porcelain Deflector) with Plain Globe.	Welsbach-Kern Inverted Burner with Plain Globe.
Data as to Quality of Gas, &c.: Barometer	30 inches	30 inches	30 inches	29 inches
Thermometer	58° Fahr.	58° Fahr.	58° Fahr.	66° Fahr.
Quality (16-candle flame value)	16·3 candles	16·3 candles	16·3 candles	16·3 candles
Calorific power (gross)	620 B.T.U.	620 B.T.U.	620 B.T.U.	625 B.T.U.
Pressure in inches of water	1·7	2·3	2·4	2·10
Corrected gas consumption in cubic feet per hour	3·7	1·2	3·2	2·76
Details of candle power. Horizontal.	52·0	16·60	52·73	56·4
10° S.	61·0	18·83	50·50	57·0
20° S.	57·0	19·34	53·46	59·0
30° S.	67·0	19·63	58·50	56·4
40° S.	59·0	18·88	53·45	60·0
50° S.	57·0	19·31	52·04	60·0
60° S.	55·0	18·33	56·78	60·7
70° S.	55·0	19·29	52·39	60·7
80° S.	57·0	22·73	57·13	57·0
90° S.	56·0	22·00	51·26	59·0
Mean hemispherical candle power	58·66	19 104	54·032	58·582
Candles per cubic foot (on mean hemispherical candle power)	15·80	15·920	16·880	21·220
Cost of gas only for 1000 candles for 1 hour. Gas at 2s. 6d. per 1000 cubic feet	**1·89d.**	**1·88d.**	**1·77d.**	**1·41d.**

think you will find that with this type a better duty is obtained with the globe than without, as it seems to have a steadying influence on the flame. Another point to be noted in these inverted burners is the wonderfully even distribution of the light.

Before I ask you to look, at your leisure, through the tables giving the details of all the enumerated tests, I should like to make one or two general remarks. Firstly, as to the candles per watt or per cubic foot. This, being taken in all cases on the mean hemispherical candle power, it is naturally lower than it would be were it taken on the maximum light. You will quite see it is not fair to take it on the maximum light because in one case the maximum light would be all in the horizontal, and in another case it would be, perhaps, at 30°, while in another case it would be directly below the burner. It may be, of course, that a zealous manufacturer in advertising his lamp, will base his advertised figures for duty on the light in the best direction for his particular lamp. This is all right as far as it goes. But it does not afford a means of comparison; and, if I may venture, I would advise all who are interested in purchasing lighting apparatus to always get a statement of the duty based on the mean hemispherical candle power. The figures for the candle powers are, of course, English standard candles, based on the Harcourt ten-candle pentane lamp; while the comparisons were all obtained on a Simmance-Abady flicker photometer (angle and horizontal type).

Now as to costs, it must be noted that I have only reckoned the cost of the actual gas or electric current consumed. I have not taken into consideration maintenance, cost of mantles, cost of carbons, cost of artificial pressure, or cost of bye-pass gas; and I am not going to put my head into a hornet's nest by endeavouring to give you an estimate of carbon costs.

You all know, with respect to mantles how one happy man runs his street-lamps on a third of the number of mantles per annum that are necessary in another town. So you see my difficulty in this direction; and you know better than I do how much, in fairness to yourself, you estimate for the cost of mantles.

As to cost of carbons, I was, within a week, speaking to two electrical engineers on the subject of a particular type of arc lamp. One was enthusiastic in his experience of carbon costs—in fact, he almost gave me to understand that the cost of carbons was a *minus* quantity. The other engineer, on the other hand, said he would not have one of this particular type of arc lamp in his district if he was paid to, as the cost of carbons was so excessive.

Another point with respect to the cost of electric lamps is that the efficiency is obtained at a particular voltage, which is frequently not that of the ordinary current. If, therefore, the voltage actually required does not divide equally into the voltage of the current, so as to put the number of lamps in series, a resistance has to be employed; and therefore, although the surplus voltage is not being reflected in the light of the lamp (being taken up by the resistance), yet in taking a set of lamps it means that the watts are higher, and therefore the efficiency is lower.

With respect to the cost of gas for incandescent lamps. If you use a bye-pass, you must, of course, add to the cost of gas consumed in the lighting hours the number of cubic feet consumed by the bye-pass in the non-lighting hours. Obviously, I have been unable to do this, because the ratio of lighting hours to non-lighting hours is not always the same, and because, even if I could strike a mean and increase the consumption accordingly, I should not be doing justice to those cases where no bye-pass at all is used, on account of the lamps being lighted by one of the special torches made for the purpose. For these reasons, I have not made any addition for the extra gas, any more than I have made any addition for the extra voltage under the circumstances I have endeavoured to make clear to you above.

I mention these points to show that, in the course I have pursued with regard to lines of comparison between one lamp and another, I have only dealt with points that are, in my opinion, quite comparable, and have carefully avoided bringing into my calculation any details which might weaken it. I have taken light against current as I found them; and debatable matters—such as maintenance—obviously cannot be dealt with in the few hours occupied by photometrical tests.

I hope that I have made the basis of comparison absolutely clear and intelligible, and that the few facts and tables which I have presented to you may be of practical service to all interested in modern forms of lighting.

Discussion.

The PRESIDENT said the paper brought out some very important points, not only in regard to the comparison of the duty obtained from gas as related to electricity, but from the various types of gas-burners, in regard to which, he must say, in these days, there was great difficulty in making the selection they wished to make—that was the best type of burner for the particular purpose which they had in view.

Mr. H. WILKINSON (Harrogate) said it seemed to him that Mr. Foreman's paper was a very creditable contribution on a subject which was at the present time occupying the attention of most of them, and also of the lighting authorities. It was a valuable paper to them, also, on the ground that it was not open to all to be in a position to make the tests which Mr. Foreman had given. It struck him, in making the comparisons of the lights, and the costs, that they were worked out upon a very fair and reasonable basis, in only stating the values of one class of light or another. It was possible that they should go from that room feeling much assurance in regard to the commodity which they supplied, as, according to the tables which had been placed before them, gas, in regard to its cost, came out by far the most favourably—with perhaps one single exception. When thinking of the comparative systems of lighting, they had necessarily to bear in mind that in the majority of streets—not in very wide thoroughfares, but in ordinary streets—the arc lamp, which seemed to turn out so favourably in regard to cost, was not the most advantageous method of illumination, because of the intense volume of light from each separate lamp. When they compared the other types of electric lighting with the Welsbach incandescent system, then the cost was very much in favour of gas. He was rather interested in the question of compressed gas, and he might say that the figures which Mr. Foreman had placed before them came out very close indeed to the results of his own experiments. He had recently at Harrogate installed two lamps of, unitedly, 1800-candle power; and the consumption, which had been carefully recorded day by day, worked out to precisely the same figure as Mr. Foreman had given. These lamps were in close proximity to what was stated to be a 1000-candle electric arc lamp; but they were much superior to their competitor, and quite put him into the shade. The reference to the inverted burner was one of much interest. In his district, this burner was taking the lead; and in many cases it was ousting the electric light. His experience, however, did not coincide with the author's, that a globe gave a steadying effect to the flame. His most successful installations had been with a naked inverted burner, with a reflector above. He found that with such an arrangement there was high efficiency, and that in the matter of repairs the costs were very much less than where globes were in use; while he had not observed any differences in respect to fluctuations of the lights. It would be interesting to know whether, in the case of the Humphrey lamp, the globe was an opal or clear one.

Mr. FOREMAN: Clear.

Mr. WILKINSON said in that case they would observe that the development of light was greater with a globe than without it. In some instances he had observed that, owing to the diffusive qualities of the opal globe, the amount of light in a room was in excess of the illuminating power developed by the naked light. Mr. Foreman had given them a considerable amount of matter to discuss, which should be of interest to them in combating the development of the competitor, which was at the door of most of them.

Mr. R. WATSON (Doncaster), speaking as a visitor, remarked that the Association were to be congratulated upon having such a good paper, and one following an equally good paper by Mr. Abady two years ago. Both communications gave a great deal of data which would be of considerable use to them all in the course of their profession. The figures given by Mr. Foreman in connection with the illuminating power of almost every type of gas-burner they were at present using would be especially handy for reference. He could confirm one or two points Mr. Foreman had alluded to. There was one in connection with the effect of the so-called self-intensified lamp, that they did better with pressure than without it. At normal pressure, therefore, he was inclined to think that the ordinary lamp was almost preferable to a self-intensified one. They obtained, perhaps, almost the same benefit at normal pressure, but not so great as they secured when the pressure began to go up (say) 2 or 3 inches in the mains. The second point was with reference to the inverted burner; and he must differ there from Mr. Wilkinson. He had tested incandescent burners under different conditions, with and without globes; and his experience had been that of Mr. Foreman—that a higher candle power was obtained when an inverted burner had a globe than when it was bare. This was undoubtedly due to the fact that the former was not subjected to draughts or wind. While he made the following remarks, they must understand that he was not complaining of Mr. Foreman having taken the topics he had done, because the data he had given were of very considerable interest to them. Many of the burners Mr. Foreman had treated of were those used for street lighting, and not so much for interiors. In the latter case, the mean hemispherical power of a burner was of considerable use, because they got the full benefit of the various rays in a room, probably due to refraction and diffusion; but with regard to streets, the conditions were somewhat different. What they wanted was a light from one lamp-post half-way to the next; and this should be, as far as possible, equally distributed. They did not want a flood of light immediately under the column, and then, about half-way between the columns, semi-darkness. Their aim, as lighting engineers, was undoubtedly to distribute the light evenly, whatever it might be. Assuming, for the moment, that they were not gas engineers, but ordinary engineers, they would naturally look for the light which would give them the best results all over the district, and would not give them darkness in the distance between the lamp-posts. What they wanted was a light the rays of which would travel as far as possible; and in getting at the value of such a light, the horizontal rays, or those approximating, were the ones which were of most service to them. In taking the mean hemispherical value of any light, they brought into their average a number of rays which were practically of no service to them—those which fell on the floor, and those which went up at an angle. Mr. Foreman, in his tests, referred, first of all, to an enclosed arc light, with a clear inner and no outer globe, as being the light which had been more particularly used for outside or street lighting. They would notice that the light of the horizontal rays was 432 candles; and when they got to an angle of 30°, the light came up to the maximum of 1180 candles. Then, further down, they got 680 candles—still higher than the horizontal. This helped to swell out the mean hemispherical average. The rays which fell at an angle of 40° or 60° were obviously small; the others, going to flood the space round the column, were of little service to the poor pedestrian who might be attacked at a distance of 20 or 30 yards away from the lamp-column. The mean hemispherical power of this enclosed arc lamp at 60° was 680 candles. He would take the gas-lamp which, as far as figures went, most nearly approximated to the enclosed arc lamp. The Lucas lamp had a mean hemispherical power of 522 odd candles; and in no case did the maximum exceed 750 candles, compared with the 1180 candles of the arc lamp. But this 750 candles was in the direction in which they wished to use the light, the rays being horizontal; and when they worked out the comparative value of these horizontal rays—as between the arc and the gas-lamp (in this case the Lucas)—they found that they got a greater efficiency from the Lucas lamp, in the distance, than they did from the arc lamp. He had occasion last year to take out the foot-candle values—that was, the light received on the ground from lamp to lamp. He would give them the comparison of the tests he made with an intensified lamp, which happened to be the Lucas; and which had to compete with an arc lamp of 1180-candle power. Obviously the amount of light given at the base of the column was greatest in the case of the arc lamp; but at the distances it worked out as follows:—

Feet Distance.	Foot-Candles.	
	Lucas.	Arc.
30	0·50	0·85
40	0·35	0·45
50	0·24	0·20
60	0·17	0·12
70	0·12	0·08
80	0·09	0·07
90	0·07	0·05
100	0·06	0·03

If they averaged from the 40 feet to the 100 feet, it was found to be, for the Lucas, 0·157, and for the arc lamp 0·143 foot-candle. Probably these figures would suggest that for distance illumination the electric light was out of it absolutely. What they wanted was equality of lighting rather that a sort of *crescendo et diminuendo* effect all along the street. He was making these remarks more particularly because he thought they should keep in mind the fact that, while even Mr. Foreman's figures on the mean hemispherical basis were altogether in favour of gas lighting, they had still something more to talk about. The figures, if taken on the foot-candle values over a given area of surface, were still more in their favour; and they could speak of them with a good deal of confidence. Mr. Foreman, again, said that most people spoke of the intensity of the light in accordance with the way in which they wished it; and the electricians referred to the arc lamp as giving 1100 candles—not adding that these 1100 candles were only obtained at about 20 feet from the column. They, of course, talked—as he preferred to talk—of the candle power of the light; speaking of the rays going out horizontally, rather than of a lamp giving a certain amount of hemispherical value, because with gas they got the mean value of the horizontal rays, which were of the most service to the user of the light. Personally he had very much appreciated Mr. Foreman's paper; and it would be worth their while to re-read and digest the valuable information given in the tables appended to it.

Mr. H. O'CONNOR (Edinburgh) said he was, like the last speaker, a chance visitor to the town, and still more, a chance visitor to the meeting. Like the last speaker, if he had known that he was to be there, and had had the opportunity of knowing the subject of the paper, and the details of it, he would have liked to have brought some figures of tests he had made of electric lights. But as he had not these figures by him, he need not enter upon them now. As Mr. Wilkinson asked a question about the globe on the Humphrey lamp, and which had already been answered, he thought it might perhaps be of greater assistance to them all if Mr. Foreman could give them details as to the globes and the reflectors in each case. He mentioned in one or two cases, "as ordinarily sold." He thought that some of the lamps named were ordinarily sold with opal globes, some with coloured globes, some with engraved globes, and some with clear globes; so a little information upon this would be of advantage. He had been making

number of tests recently with inverted gas-burners; and he had found that there was nothing so easy to upset as the conditions which were to be found in the use of these burners. He supposed that there was nothing so unscientific that they used with gas as the inverted burner. It was entirely opposed to all the principles of combustion. They were trying to make the flame burn downwards, instead of upwards—they were making it do so, and they were taking what heat they could get from it to heat the mantle; but it was entirely against all the theories of heat rising and of the issuing of gas. It was the issuing of the gas at a fair pressure that was injecting the air, which was to mix and to burn at a lower level than where the injection took place. Consequently he had found, in the experiments he had made, that they could not too carefully prevent currents of air every way from touching the flame, because the slightest movement of the flame or the mantle so that the edge of the flame was exactly at the point where the mantle was, would vary the amount of the light given to an enormous extent. They knew that the hottest part of the flame was the outside of it, and therefore that the mantle should be placed in the hottest part of the flame. If they upset this condition, they reduced the illuminating power very enormously. He would also like to ask Mr. Foreman whether the tests that he made were always under conditions as to pressure which would be most suitable for the light that was being used.

Mr. FOREMAN: Certainly.

Mr. H. TOBEY (Malton) asked Mr. Foreman whether he had made any tests with the "Tantalum" lamp. He had given them tests regarding a number of lamps; but he thought this one had been omitted. In their old town of Malton, the electric people commenced with 70-candle power glow lamps; afterwards they substituted Nernst lamps; and now they had replaced them by Tantalum lamps, which seemed to give an excellent light, not only in a downward direction, but also horizontally. The electric light people told him it took less current, and it looked to him to be rather a formidable competitor with incandescent gas-lamps.

Mr. FOREMAN, in closing the discussion, said that, as to the question Mr. O'Connor raised, he stated that the Humphrey lamp was tested with a clear globe and opal shade; the Lucas lamp with a clear globe and an opal shade; and the Welsbach lamp with a clear globe and an opal shade. The Tantalum lamp he had not had the pleasure of testing yet; but he hoped to get hold of it, and at a later date he might be able to supply them with figures as to it. Electricians made great claims regarding its efficiency; but he believed they would have great difficulty in this, that they could not make it for a high voltage. He believed that the highest voltage they could run it at was 105 volts, which meant the re-wiring of the fittings, so that they might be able to run it in series. The reason why he gave the mean hemispherical candle power and the mean hemispherical power at each angle was that foot-candles could be worked out from them by the usual formulæ. He thanked the members for the kind way in which they had received his paper. It was his first attempt at reading a paper, and his first visit to the North of England Gas Managers' Association; and he could not tell them how highly he appreciated the way they had received him that afternoon.

British Institute of Social Service.—We have received the second number of "Progress," the quarterly organ of the British Institute of Social Service, in which an endeavour is made to arouse interest in, and disseminate information upon, all efforts in the direction of the amelioration of civic, social, and industrial conditions. One of the articles is on "German Labour Bureaux," by Mr. A. Holden Byles, B.A., the Editor.

Edinburgh Gas Commissioners' Coal Contracts.—Our Scottish correspondent telegraphed yesterday afternoon as follows: The Edinburgh and Leith Gas Commissioners have accepted tenders for 170,000 tons of coal for the year, of which 35,000 tons are cannel and the remainder common coal. The quantity is a reduction of 10,000 tons upon last year; but there is a large quantity contracted for undelivered. The price is 12s. 3·05d. per ton, compared with 12s. 1·08d. a year ago. Provost Mackie, of Leith, the Chairman, considered an excellent purchase had been made.

Wales and Monmouthshire District Institution of Gas Engineers and Managers.—We learn from the Hon. Secretary (Mr. Octavius Thomas) that the first annual meeting of the Association will be held at Newport, Mon., to-morrow (Wednesday), under the presidency of Alderman T. Canning, J.P. The report and accounts will be submitted, and officers for the ensuing year, and new members, will be elected. A notice of motion by the Secretary as to affiliation with the Institution of Gas Engineers will be considered; and in addition there will be two papers. The first will be by the President, on the "Durability and Illuminating Value of the Incandescent Mantle;" and the other by the Secretary, entitled "A Few Notes about Gas-Mains." The meeting will then adjourn for luncheon, by the kind invitation of the President; and thereafter the members will be conveyed in brakes to the Crindau Gas-Works. Subsequently visits will be paid to Messrs. Lysaght's Engineering Works, and to the Transporter Bridge, a description of which will be given by Mr. R. H. Haynes, the Borough Engineer.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

The Question-Box.

The April Meeting of the Association was held on Friday evening at the Regent Street Polytechnic, the business being the discussion of a number of questions that had previously been sent in to the Hon. Secretary (Mr. P. F. Scarth). The list was so long, however, that the time at disposal did not permit of even half of the number being considered; the remainder being left over for the annual meeting, to be held at the end of this month. One or two members who were not able to attend sent written replies to some of the questions. In the absence of the President (Mr. Walter Grafton) and the Vice-Presidents, Mr. F. Ainsworth was voted to the chair.

Why is not slack (for carbonizing) in more general use for gas making?

Mr. Scarth remarked that he thought most people used unscreened coal, and that contained slack. Some preferred nuts; but the majority, he believed, liked unscreened coal, which made better coke. Mr. H. J. Carpenter said unscreened coal was generally used, and that comprised nuts and slack. The great objection to slack was in the handling; but it seemed to him that it would certainly be considerably cheaper to use than nuts. In a written reply, Mr. Upton said he should take it that the drawbacks against the use of slack were that, owing to its small physical condition exposing a large area to the atmosphere, a considerable quantity of gas must escape, with less gas make on carbonization; and also that with "small" there might be a larger amount of impurities—such as pieces of roof and pyrites. Bearing on this were the frequent installations of coal-washing plant at collieries. However, if coal was bought from the east coast for export, it had to be taken unscreened, and therefore with a large amount of small; and as the Continental buyers were satisfied with it, and got good results from it, it would appear as though small was of value. By the time ordinary coal had been through the breaker, he should say it was pretty much the same as unscreened, and so contained a large amount of small. Small coal, lying closer together in the retort, should make a denser coke, with probably a lower candle-value gas, owing to there being no air spaces, and to the gas having to force its way through the hot coke. Mr. S. Carpenter was of opinion that one reason why slack was not more often used was that there was a good deal against it in respect to the quality of gas and make per ton. It was not only carbonizing coal in a fine state, but, as he understood it, the slack was simply the screenings from the coal, which were thrown out into heaps, and got wet, and so one had a lot of dirt mixed with it. He knew from having tried it that, slack made a good dense coke. Mr. Ainsworth said some slack had in it less stones and things of that sort than coal.

It is stated that, when anti-dips or retort-house governors are used, the make of gas and its illuminating power increase. Why is this?

Mr. S. Carpenter said he supposed it was owing to the steadiness of the retorts—they got the pull just when they ought to do so. Mr. Scarth said it seemed to him the obvious reason was that they did not get the pressure thrown on the retort that they would with a hydraulic main. The object in good gas making was, of course, not to have too great a pressure on the retort, as it only led to formation of scurf, with a consequent reduction in illuminating power. Mr. Upton pointed out that, the quantity of gas in coal being strictly limited, it followed that if a greater yield was secured by one process as against another, there must be a loss in the process yielding the smaller quantity. If the retorts were under pressure in the one case, and at a level gauge in the other, then gas must either be lost through cracks, &c., or it was broken down to compounds having a less volume. The greater candle value must arise from the fact that the gas was removed from the destructive effects of the heat more quickly in the case of the one system than in that of the other.

Does a tower scrubber have any influence upon naphthalene deposits? Is it merely a coincidence that in two works that have tower scrubbers the inquirer has noticed that there is no trouble with naphthalene; while in two others, one of which has a Cockey washer and the other rotary washer-scrubbers, both are more or less troubled with naphthalene?

One member suggested that the case mentioned was merely a coincidence, because water had no effect in the removal of naphthalene. Perhaps, however, in one instance water gas tar or something of the kind was being used in the scrubbers; whereas in the others water only was employed. Mr. Scarth thought a tower scrubber had an influence on naphthalene, as in that case there was a gradual coating of tar in the apparatus; while with rotary washers, for instance, there was hardly any tar. The members had seen at Vauxhall a tall cylindrical apparatus filled with tubes; and, as a medium for extracting naphthalene, they pumped up tar, and allowed it to run down these tubes, and so come into direct contact with the gas. Therefore it

seemed to him that the tower scrubber did have an influence on naphthalene. Mr. S. Carpenter remarked that he knew a works where the scrubbing was carried on with a tower apparatus and later on with a rotary scrubber; and they never had any trouble with naphthalene. Mr. Scarth thought a possible explanation of the question might be that when the rotary scrubbers were put in the works generally were modernized, and fresh carbonizing plant introduced, and that with higher heats more naphthalene was formed. Mr. Grimwood remarked that it would be interesting to know what coal was used at the different works, because he believed it was recognized that naphthalene was deposited more with Newcastle coal than with coal that came from the Midlands. Mr. Mitchley wrote saying he had noticed the same conditions at King's Lynn. They put in a Walker purifying machine, and had not had a case of naphthalene since.

What is your opinion of the present official method of testing gas meters for correctness of registration?

Mr. Wall remarked that some further explanation of the exact meaning of the question would assist the members in discussing it; and Mr. S. Carpenter said that as he was the inquirer he would tell them what was in his mind at the time. Some short while ago, in a particular shop, the consumption fell during the winter quarter to about 25 per cent. of the normal amount. The meter was taken out, sent to the testing office, and certified to be 13 per cent. fast. Another meter was put in; and since then (the affair occurred about twelve months ago) the consumption had been normal. His own opinion of the official method of testing was that it was quite useless, owing to the low pressure at which they tested. He followed a good many cases afterwards; and the same result was shown, though not to quite such a large extent. Mr. Tooth thought everything depended upon the pressure at which one was working. His experience was that under 3 inches pressure a meter always worked slow. Mr. Carpenter said his point was that the pressure used at the official testing-station was too low to give results accurate in general working. Mr. Grimwood remarked that meters were always officially tested at 5-10ths pressure. Mr. Vere said his experience led him to believe that the handling of the meter had something to do with the matter. In his part of London many meters which they knew had come to a dead-stop had been taken out; and after this movement they had been found to be correct. The only really satisfactory way was to test the meter *in situ;* but this was very seldom done. Mr. Wall said the existing method seemed to be universally condemned; but the question was, What was the remedy? Pressures, of course, varied; and it was not possible to get either a wet or a dry meter that would register absolutely correctly (say) both at 30-10ths and 50-10ths. One remedy would be to test the meters at an average pressure—that was to say, if the pressure in the district varied between the figures he had just named, to carry out the test at 40-10ths pressure. Mr. Ainsworth remarked that there was no doubt this was a very important subject, and one that required careful attention. Of course, great variations in consumption were met with; and in these cases it was better for the inspector to test the meter before questioning the customer too much. At Ilford, if a tenant left a house, and there was no application for the meter, it was brought to the works and then tested. There was no doubt meters did vary; but, taking them on the whole, they did fairly well if they were procured from good makers. While he was among wet meters, he had been a firm believer in them; but he was now thoroughly converted to the dry pattern. His opinion was that dry meters would be more used in the future than at present. Gas suppliers could not afford to put people to trouble; and everyone knew that where there were wet meters, the gas-fitter, or whoever was doing the fitting, had to be very careful. His idea was that wet meters had seen their day. In his district they did not test meters as they were received from the makers. Mr. S. Carpenter: Do you not think there is a risk of them getting shaken if they come by rail? Mr. Ainsworth replied that there might be a risk of this. Continuing, he said he had known cases such as had been mentioned, where valves had got fixed when the meter was in position; and when it was removed to the works, they went all right.

What is the cause of the low average attendance at our meetings?

Mr. H. J. Carpenter suggested that the day of the week on which the meetings were held might have something to do with it; while Mr. Upton thought that the London district offered too many competitive engagements. Mr. Grimwood was in favour of occasional lectures by engineers, as a remedy. This would attract persons, who, if they came to one meeting, would come again. To this proposal, Mr. Scarth added an annual dinner, which would bring the members more together; and also a summer outing. Mr. Wall said it simply amounted to this—that the low attendances were solely due to want of attraction. Therefore the question arose, What could be done to make the meetings more attractive? It was a subject that needed more time than they then had at disposal; and a special meeting might be called to consider it. Mr. Ainsworth thought a programme ought to be prepared at the beginning of the session. Lectures and a dinner would be very good; but he would not favour an outing, unless it was combined with a visit to a gas-works. They should try to enlist the sympathy of the chiefs of gas-works, so that they would speak to their juniors on the subject of the Association. Mr. Mitchley thought members did not like to write papers for fear they might not be considered good enough. He was of opinion that such a meeting as the present one would be more likely to "take," as all members could find some point to talk about in the list of questions submitted.

Do you have any difficulty in inducing builders to pipe their houses for gas lighting when electricity is available? If so, what measures do you adopt to overcome the difficulty?

Mr. Wall said this was a subject on which he had had some little experience. There was undoubtedly a great difficulty in inducing builders to pipe houses, because most electric light companies did the wiring free of cost. Frequently the electrical people had a clause in their agreement with the builder that, on consideration of the wiring being done free, they would undertake that no gas should be supplied to the tenant of the house, other than for heating purposes. The consequence was that where a builder was induced to permit the wiring of a house, and signed the agreement, it meant that for a period of perhaps five years it was impossible to supply the house with gas for lighting. To his mind, the only successful method of competing with this condition of affairs, was to offer the builders greater inducements than the electrical people did; and this, of course, meant expense. When a company were prepared to spend (say) from 30s. to 50s. per house, he thought that, despite the fact that electricity was considerably dearer than gas, every builder would have his house wired. The matter rested entirely between the builders and the gas company. Mr. Upton said that the owners of houses left the question of gas supply to the architect, the architect left it to the builder, the builder left it to the plumber, and the plumber waited for orders. His impression—obtained from personal observation—was that the electric light man hustled, while the gas man waited for the other man to come and look him up in the gas office. He was aware of hundreds of new houses—in fact, he had got one himself—where there was no convenience for a gas-stove. The builder told him he did not trouble to form a recess for a stove, as there was no inducement to do so. He added that he had never seen anyone from the gas office on such a question. Mr. Vere remarked that in his part of London they did not have much trouble in getting builders to put in pipes; but in an extreme case, they put them in themselves. They did not let a place stand without. There were a lot of flats in his district; and if once the flooring was put down without the gas-pipes being in, the business was lost for good. Of course, all the flats were wired, and they could not get very much of the lighting; but they put points to every fireplace, and if lighting was wanted it was a simple matter afterwards to put the pipes in. Mr. Carpenter asked whether he found people equally divided in preferring electricity or gas in houses which were wired and piped. Mr. Vere replied that it all depended on the class of people. He found that in big houses there was gas in the servants' quarters, and electricity everywhere else. Mr. Ainsworth said, with reference to trouble in getting builders to pipe houses for gas when they were being erected, he believed this was becoming more difficult as time went on—especially where the suppliers of electricity were wiring the houses free of cost. When this was done the gas companies must follow suit—particularly seeing the great advantage they had over the electricity suppliers regarding cheapness and the use of their commodity—both in winter and summer. In his district (Ilford) the Council were the first to place free wires and fittings with their slot meters (even where the Gas Company had already put in pipes, fittings, and cookers). They also wired and put in fittings and made a nominal charge of 1s. 3d. a quarter, until they had spent all the money they had for this purpose. They had some builders who were putting up hundreds of houses letting at from 9s. to 11s. 6d. per week inclusive of rates; and they were wiring and putting elecric fittings throughout—having arranged with the Council to put slot electric meters where required at a small extra charge for current. In one road where the rents averaged 9s. to 9s. 6d. per week, his Engineer arranged a canvass for the slot system, with fittings and cooker—one fitting, with incandescent burner, to be put in the living-room. Through a slight misunderstanding, he (Mr. Ainsworth) arranged for the gas-fittings to be put in along with the existing electric fittings; whereas the Engineer's idea was to get the electric fittings removed and those for gas put in their place. However, as things had gone so far, it was decided to continue on the same lines as an experiment in this particular road. Now the Gas Company had got nearly every consumer to take a slot-meter and two gas-fittings. They were very pleased with the incandescent burner, and were using nothing else in the living-room, though electricity was available. The Company were waiting to see what the results would be in twelve months' time; and if the trial were successful, it would make the purveyors of electricity more careful in spending so much money to capture the small consumers. His contention was that if suppliers of electricity were going to wire the houses free when in course of construction, it was of great importance that gas companies should give the same inducements. By doing this, they could keep out electricity, especially considering the advantages they had at their command, and the various uses to which gas could be put when once on the premises.

The resignation by Mr. W. E. Dean of the position of Junior Vice-President (on his leaving for Torquay, as already announced in the "JOURNAL") was then accepted; and it was resolved to

tender to him the sincere thanks of the Association for his services in the past, and their best wishes for his welfare in the future.

It was announced that there would be a visit to the Harrow Gas-Works on the 12th inst.; and the meeting concluded with a vote of thanks—proposed by Mr. Grimwood and seconded by Mr. H. J. Carpenter—to Mr. Ainsworth for occupying the chair.

JUNIOR ENGINEERS AT CROYDON GAS-WORKS.

Extensions—Recent, Present, and Projected.

For some few years past, the Croydon Gas Company's works have never been wholly free from the builder or the plant supplier—at least, that is the impression one has on looking back at occasional visits; and the next few months will see further activity there. Modernizing has been in some degree responsible for this, but expansion of business claims the greater part.

In the year 1902 or 1903, the writer stood with the Engineer (Mr. J. W. Helps) outside the newly-erected building in which the retort-bench furnaces were then under construction, and looked with admiration upon the structure, which was then some 196 feet long and 72 feet wide, with a coal-store the same length, but 50 feet wide, on the other side. The house was required to supplement Nos. 1 and 2 retort-houses that had served the Company's purposes up to then. The one was 164 feet long and 60 feet wide, and the other 168 feet long by 60 feet wide. The years since have been years of sharp competition with electricity; but notwithstanding, during them the No. 3 house that, with its 196 feet of length, was so greatly admired thirteen years ago, has, compulsorily, had to be extended to 390 feet, and is known as Nos. 3 and 4. The building now contains 29 settings of eight retorts, ⌂ shaped, 22 in. by 16 in. throughs. It is really, judged from a retort-house standpoint, a magnificent building. West's compressed-air machinery that worked the benches in No. 3 easily performs the whole of the work in the doubled house. It is in a house of such capacity as this where stoking machinery and the men have the best chance of giving a really good account of themselves, and where the greatest impression is made on carbonizing costs. But that is not the whole of the story. As a description of the works published some time since showed, carburetted water-gas plant has been erected since 1897, in three instalments, capable of producing 2½ million feet per day; and plans have been prepared, and contracts accepted, for the erection, on land at the south end of the works, of a new section of works (exclusive of retort-houses) on modern, and it is believed on somewhat novel, lines, capable of dealing with about 4 million cubic feet of gas per 24 hours, the whole of which it is hoped will be ready for use during next winter. When this section is finished, it is intended to entirely remodel the existing condensing, scrubbing, and washing plant. It is true the Carshalton and Caterham districts have been added to the Company's area; nevertheless, the growth of the business in the old district, which has been the main cause of these great extensions, has, these facts alone show, been remarkable. Take 1896 as an example, the consumption of gas was 592,977,000 cubic feet; in 1905, it was 1,009,000,000 cubic feet, with municipal electricity in opposition.

Of course, all other parts of the plant have been extended to the necessary scale, new machinery has been adopted, including an extensive system of De Brouwer coke conveying and distributing plant, together with siding extensions (elevated and ground) for facilitating the incoming and outgoing of materials. Most of this work, however, has been described on previous occasions. Among other recent work, the character of which for the present need only be indicated, is an additional governor-house, which contains three governors, by Messrs. Parkinson and W. & B. Cowan, Limited, arranged to stand a pressure of 24 inches of water. There is room for a fourth governor; but the connections are at present used as a direct high-pressure supply through a 20-inch main, about 6 miles long, by which the holders of the lately acquired Caterham works will be filled when manufacture is discontinued there some time during the present year. A building has also lately been erected for boosting purposes. It will accommodate two pressure-raising Sturtevant fans, driven by De Laval steam-turbines, each set being capable of delivering over 600,000 cubic feet of gas at an outlet pressure of 24 inches of water. In connection with the water-gas plant, a large "Rotary" meter has been installed. Then at the north end of the works, an extensive building is approaching completion, which is designed for carrying out, on the most approved principles, the cleaning and repairing of heating and cooking stoves. It will also contain properly provided meter testing, tinman's, and brass-finishing shops. At one end, too, are a suite of light drawing-offices, staff dining-rooms, with men's mess-room below. Future plans contemplate the linking up of Nos. 1 and 2 retort-houses, the conversion of the settings to the regenerative principle, the installation of stoking machinery, and the erection of a new and more modern sulphate of ammonia plant.

This general outline of recent, present, and prospective work is given while the schemes of change and extension are yet incomplete, to show something of the interest that a considerable number of the members of the Junior Institution of Engineers found awaiting their inspection when on Saturday last they, accompanied by their Chairman (Mr. Adam Hunter) and Secretary (Mr. Walter T. Dunn), visited the works. Mr. J. W. Helps personally received them, and headed the first of the three parties into which the visitors were divided. His chief Assistant (Mr. A. Caddick) and Mr. Harrisson, head draughtsman, led the other two parties. Mr. Helps, and not less those who aided him, were unwearying in their exertions to explain the processes of manufacture from coal-store to holder, and the methods of dealing with the residuals; and it must be said that they all found they had an intelligent and a receptive following. The visitors received further hospitality in the shape of tea in the new drawing-office. Afterwards, Mr. Adam Hunter acknowledged, in appropriate phrase, the indebtedness of the members to Mr. Helps and those who had assisted him, at the same time informing the members of the high place that Mr. Helps occupies in gas engineering, and of the esteem (which has been emphasized in the most pronounced manner that the gas profession can command) in which all engaged in the industry hold him. Mr. Helps accepted the kind words in the same spirit that prompted them, and heartily thanked all for their appreciation of the willing service of himself and his assistants. He spoke, too, of the opportunities that the gas industry offers to young men who have an aptitude for gas engineering and management, and who enter it with the resolve to make their mark by doing something to aid its progress in one way or another. Many of the members subsequently spent time in inspecting the drawings of the extensions exhibited in the new drawing-office.

West's Coal Projector and Discharging Machine for China.

The Shanghai Gas Company, on the recommendation of their Engineer (Mr. H. King-Hiller), have placed a contract with the West Gas Improvement Company, Limited, for a complete installation of stoking machinery, comprising electrically driven coal-projector and discharging machine, together with two complete lines of coal-handling plant, also electrically driven, and the necessary dynamos and gas-engines. The machines are to be similar to those working at the Stapleton Road Gas-Works, Bristol, which machines we recently described, and which Mr. King-Hiller inspected during his recent visit to this country. It is remarkable how stoking machinery has spread itself of late in all parts of the civilized world. This particular coal-projector for retort-house operation will have historical interest attaching to it, as, to the best of our belief, it will be the first of its kind to have entrance into China. We learn that the West Gas Improvement Company, besides machinery for Beckton and Manchester, have installations in hand, on their various systems, for Copenhagen, Warsaw, Hanover, and now Shanghai.

Gas-Meter Testing at Edmonton.

At the Meeting of the Middlesex County Council on Thursday, the Chairman (Sir Ralph Littler) submitted a report upon the work done at the gas-meter testing station at Edmonton, which was opened in July, 1900. The staff at the station consists of one inspector, six assistants, two junior assistants, one clerk, and one labourer. The number of meters tested and the amount of fees earned during the five years ended March 31 last were as follows: 1901-2, 74,045 meters and £2289 7s. fees; 1902-3, 80,472 meters and £2490 15s. 10d. fees; 1903-4, 88,349 meters and £2632 13s. 6d. fees; 1904-5, 86,495 meters and £2575 14s. 6d. fees; 1905-6, 79,533 meters and £2371 13s. fees. As will be seen, the fees for the last two years and the meters tested have decreased. This it is believed was due to the opening of a testing-station at Glasgow, with the result that many meters which would have been examined at Edmonton are now sent to Glasgow. The net profit derived by the Council from the station during the last two years amounted to about £2000. During the twelve months ended March 31 last, 2089 meters were received from gas companies, of which number 519 were stamped, and 1570 were rejected. During the same period, 77,444 meters were received from makers, and 74,765 of them were stamped and 2679 were rejected.

Winding Up of the St. Neots Water Company.

A winding-up petition, presented by Messrs. Baker and Lees, Parliamentary Agents, who had obtained judgment against the Company for £1764 4s. 6d., came before Mr. Justice Buckley in the Chancery Division of the High Court of Justice, last Wednesday. The unsatisfied claim was in respect of work done and money paid in obtaining the Bill under which the water-works were constructed. The Company was incorporated on Aug. 6, 1897, with a nominal capital of £9000, in shares of £10 each, afterwards increased to £13,000, for the purpose of making and maintaining water-works and supplying water within certain limits prescribed by the Act. The petition has been standing over since December, with the view of enabling the Company to sell the undertaking to the Local Authority; but the negotiations having proved abortive, the petitioners now asked for a compulsory order. For the Company it was urged there was an understanding that time should be given to enable the debt to be paid; and, further, that the convenience of creditors ought not to be allowed to supersede the undoubted interests of the public in having a water supply. The petition was opposed by several large creditors—including Messrs. Docwra, the Contractors, who had a claim of £2482 in respect of work done. Mr. Clanson appeared for the petitioners, Mr. Palmer for the Company, and Mr. Spence for opposing creditors. His Lordship made the usual order for compulsory winding up.

REGISTER OF PATENTS.

Automatically Delivering Bills of Gas-Meters, Water-Meters, and the Like.—Gallagher, R. W., and the Automatic Meter Company, of San Francisco, California. No. 9652; May 8, 1905.

This invention (relating to an improved device for automatically delivering bills of meters, &c.) has for its object to provide means by which the inspector of the meter, instead of reading the meter and making a record, which is delivered to the office, from which a bill is afterwards presented to the consumer, will at once take a duplicate record of the same—one of which will be presented to the consumer as a bill, and the other will be handed in at the office—while a third record will be retained in the meter as a check upon the bill collector.

The somewhat complicated mechanism involved is not described by the patentees in their specification apart from a series of six sheets of detail drawings, which there is no opportunity of reproducing.

Incandescent Gas Fittings and Burners.—Helps, G., of Nuneaton. No. 10,725; May 23, 1905.

In patent No. 2805 of 1905, there was described a method of supporting an atmospheric gas-tube for use with a mantle at a point between the gas-nipple and the burner; the nipple being situated at one end of the tube and the mantle at the other. There was also described (but not claimed) the application to such a burner of a movable plug to which the gas-nipple is attached. The present invention relates to a movable plug or barrel to which the gas-nipple is attached, so as to allow of ready access to the gas-nipple, as a ground plug in which the gas-nipple is contained may be used in conjunction with a ground socket or barrel to which and the nipple in the plug a suitable gas connection is made. The plug may be secured to the barrel or socket by a bayonet joint or other suitable fastening; thus allowing the plug to be removed most readily and the nipple cleaned, changed, or adjusted. The burner is so arranged that it remains in position, and only the combined nipple block and plug is removed.

Fig. 1.

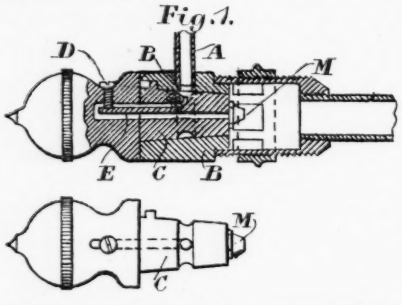


Fig. 1 is a section of a gas connection with barrel and movable plug. A is the gas connection, B the barrel or socket, C the movable nipple plug, D the screw closing the gas-way to the nipple, E the gas-way to the nipple, and M the nipple. An elevation of the nipple plug removed is also given.

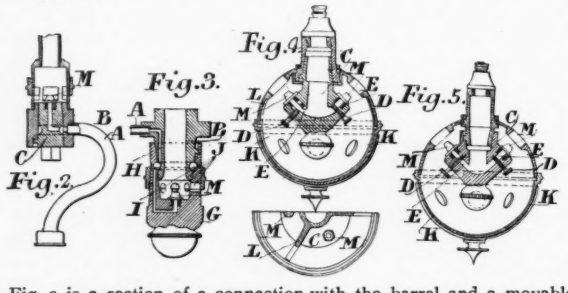


Fig. 2 is a section of a connection with the barrel and a movable plug suitable for use in lanterns.

Fig. 3 is a section of an arrangement by which the nipple is attached to a movable barrel or socket. Here G is the movable nipple barrel, H the gas-way in the barrel B, I the gas-way in the movable nipple barrel, while J are holes for the admission of air.

Fig. 4 shows the adaptation of a movable nipple plug to a burner such as shown in patent No. 2733. In this, K is the air cone or chamber, and L the web shown in the plan.

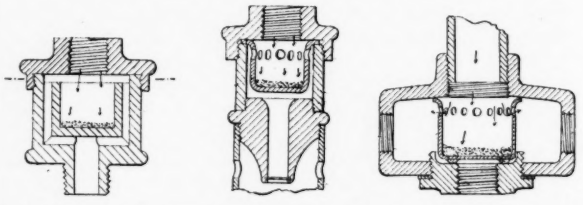
Fig. 5 is a section of an air-chamber and movable nipple block similar to fig. 4, but having a socket-nipple block in place of the plug-nipple block.

Incandescent Gas-Burner Fittings.—Jennings, J., of Blackburn. No. 11,087; May 27, 1905.

This improvement in incandescent gas-burner fittings comprises a chimney for use in connection with a "Kern" or other ordinary burner; the chimney being constructed in such a manner that, in the event of a mantle breaking, it is prevented from falling between the chimney and the burner on to (possibly) some inflammable substance; and danger of fire is thus prevented. The invention also comprises a dust-proof cover for use in combination with the chimney of an incandescent burner when the latter is not in use, and an improved carrier for securing the shade to a gas-bracket. The lower end of the chimney is constructed to about the diameter of a "Kern" burner, and terminates in a collar or sleeve corresponding in shape to the tapered portion of the burner which supports the chimney. A dust-proof cover may be used in combination with the chimney; but when the burner is not in use, the cover is preferably formed with a rounded top and having a flange which fits inside the top of the chimney, and so holds the cover in position. The carrier for securing the shade is punched out to fit on the screw of the burner, and is bent so as to fit into two ferrules, and thus dispense with suspension cords or brackets.

Dirt Retainers for Inverted Gas-Burners.—Lake, H. H.; a communication from the Deutsche Gasglülicht Aktiengesellschaft (Aüergesellschaft), of Berlin. No. 12,605; June 17, 1905.

This invention relates to a dirt retainer for gas-nozzles—more especially in inverted gas-burners—so as to prevent dirt or impurities contained in the gas-pipes from reaching the nozzles and stopping them up. Contrary to the case with known dirt retainers—in which the current of gas is deflected laterally for the purpose of separating the impurities—in the present invention, the particles of dirt are separated from the gas current before the latter is deflected laterally. This is

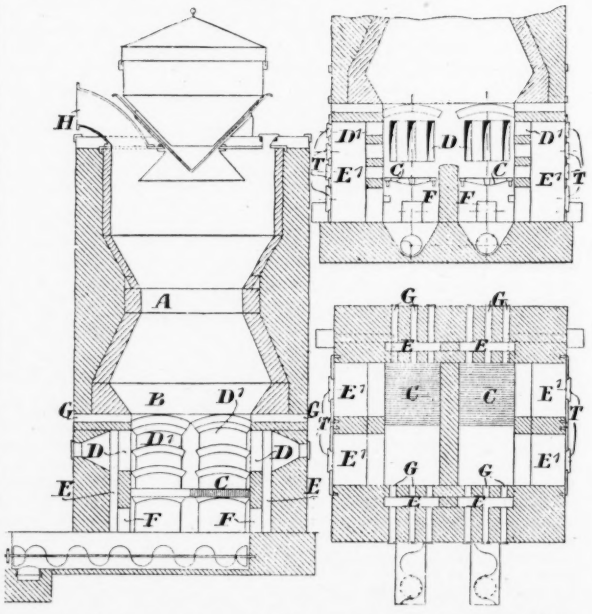


effected owing to the fact that the dirt-retaining receptacle is arranged (as shown) in continuation of the gas-pipe towards which its aperture is directed. As a result of this, the particles of dirt, after leaving the gas-pipe, are said to fall directly into the retaining receptacle without deflection of the current of gas. The velocity imparted to the particles of dirt by the gas current is therefore utilized for conducting them on to the bottom of the dirt retainer; while the effective deposit of the impurities is facilitated owing to the fact that the gas is at rest in the retainer, as the lateral deflection of the purified gas takes place at the upper part of the retaining receptacle. In this manner any eddying of the impurities contained in the receptacle is prevented.

Vertical Kiln for the Gasification of Peat.—Ziegler, M., of Beuerberg, Upper Bavaria. No. 18,174; Sept. 8, 1905.

This invention relates to the distillation of peat and similar materials for the purpose of obtaining heat and power gas, sulphate of ammonia, methyl alcohol, and the like.

The kiln or generator comprises a vertical shaft, which is alternately contracted, as at A, and expanded on each side or all round it, and which shaft terminates at its lower end in a chamber, all the walls of which are provided with numerous perforations or openings D D^1 for the introduction of air. The walls of the lower chamber, together with the grate C, thus form a cage, through the openings in which the air necessary for combustion is introduced from below and at all sides. For this purpose the chamber communicates with the passages E in the walls of the kiln by the openings D; the air (preferably under higher than atmospheric pressure) entering the passages



from the ash-pit through openings F. The ash-pit also communicates with the air-chambers E^1, into which the inlets D^1 open and which are accessible from the outside through doors T, so that the working of the kiln may be watched. The openings for the inspection of the fire are preferably so placed that they coincide with the vertical openings of the cage containing the peat.

The openings D are narrow, rectangular vertical slits; but the openings D^1, through which the air-chambers E^1 communicate with the

interior of the generator, are arch shaped and horizontal. These openings are preferably constructed by arranging concentric arches at some little distance apart, so as to leave the requisite space between them. To enable the charge to be retained in the kiln while repairs are being effected to the grate, or fire-bars are being renewed, special slits or openings G are provided in the walls, through which a temporary grate may be inserted.

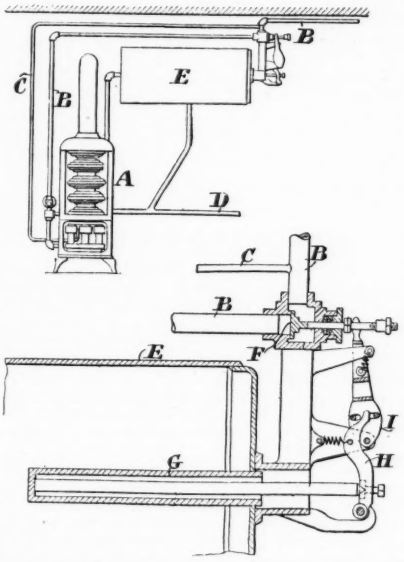
The kiln is always kept filled. The peat, introduced at the top, remains for some time in the upper part of the shaft above the narrow part A; the hot gases passing through the body of peat and expelling the more volatile constituents and converting the peat into coke. As the coke is formed, the peat is reduced in volume, and the coke passes gradually through the contracted part A and into the space between the contractions A and B. In this space the coke is gasified, and the products of the destructive distillation escape and rise through the pipe H leading to plant for the recovery of their constituents.

Controlling Gas Supply to Water-Heaters.—Ruud, E., of Pittsburg, U.S.A. No. 19,276; Sept. 23, 1905. Date claimed under International Convention, March 27, 1905.

This invention relates to a storage water-heater system in which there is a service for operating a gas-supply valve in accordance with the movement of a thermostatic regulator.

The illustration shows a view, partly in elevation and partly in section, of the storage water-heater system and a sectional view, on an enlarged scale, of the thermostatic regulator, controlling valve, and operating mechanism.

The system comprises a water-heater, a hot-water storage tank or reservoir, water supply and connection pipes, and gas-supply pipes. The heating appliance proper consists of a coil A, located in a casing or jacket and heated by burners, to which gas is supplied by the pipe B; the products of combustion being carried off through an exit flue or stack at top. A small pilot burner is supplied with gas by the pipe C, which ignites the gas at the main burners as from time to time required. Water is supplied to the heating coil by the pipe D, and circulated through the coil and storage reservoir by pipes in the usual manner.



In connection with the storage tank E is a thermostatic regulator, connected, through operating mechanism presently to be described, with a controlling valve F, by means of which the supply of gas is fully opened to, or entirely cut off from, the hot-water storage tank, accordingly as the circumstances of use may require the heating appliance to be operative or to be inoperative without waste of heat, as the case may be. In the instance shown, the thermostatic regulator consists of a metal tube G, inserted in the hot-water storage tank enclosing a rod of metal having a lesser degree of expansibility than the tube, inserted in and projecting outwardly from the tube, through an opening in a supporting frame fixed to the reservoir. The controlling valve is fitted to seat in a valve chamber or casing interposed between adjoining sections of the gas-supply pipe B, and is actuated by the thermostatic regulator through intermediate operating lever mechanism.

The outer end of the rod abuts against a lever H, pivoted to a bracket on the frame, and maintained in contact with the rod by a spring, so that the lever shall be moved outwardly by the rod and inwardly by the spring. The free end of the lever is movable to abut against one or the other of two pins, fixed upon a lever I, pivoted to a bracket on the frame above the lever H, and coupled, by a spring, to a bracket on the frame; the spring being inclined relatively to the lever, so as to act with leverage on the lever I, and throw it, when moved by the lever H, to the extremities of its admitted pivotal traverse. The free end of the lever I is forked to embrace the stem of the controlling valve, and traverses between stops, in the form of nuts, adjustable on screw threads on the stem.

When the temperature in the reservoir E begins to fall, the pipe G, of the thermostatic regulator, contracts and moves the lever H outwardly. In its outward traverse, the lever abuts against the pin of the lever I, and in turn moves it outwardly, until its centre line passes the fulcrum of the spring, which thereupon throws it to the outer extremity of its traverse, in which movement it abuts on the outer stop on the stem of the controlling valve F, and opens the valve to its full extent. Gas is thereby admitted, through the full capacity of the pipe B, to the main burners of the heater, which are ignited by the pilot burner; and the heating of the water continues until the water in the storage reservoir at the level of the thermostatic regulator attains the desired temperature.

Spontaneously-Igniting Incandescent Mantle.—Pick, M., Fischel, I., and Imiela, G., of Berlin, and Wallnig, E., of Steglitz, near Berlin. No. 19,435; Sept. 26, 1905.

Incandescent mantles are already known, the patentees remark, wherein spontaneous ignition is secured by means of a small quantity of platinum black. The fact has, however, "heretofore escaped observation" that the action of such spontaneous igniters is considerably enhanced by diminishing the distance between the ignition pellet and the point at which the gas enters the mantle. It has heretofore been usual to arrange either one large pellet or several small ones near to the upper end of the mantle. Now although oxygen (the agent by means of which the combustion process is maintained) is undoubtedly present in sufficient quantity, it nevertheless occurs that the ignition pellets, when attached to the top of the mantle, are not raised to a sufficiently high temperature to effect ignition—principally due to the fact that a higher temperature is required to effect the ignition of the gases at the top of the mantle than at its lower end. Moreover, "special stress must be laid on the fact that nitrogen, the influence of which has heretofore been entirely neglected in incandescence technics, plays a part in the process which must by no means be left out of consideration, as, being an inert substance constantly supplied, it unnecessarily lowers the temperature of an ignition pellet attached to the upper end of the mantle."

This invention relates to a spontaneously-igniting incandescent mantle in which the temperature necessary to effect ignition is said to be completely attained. The essential feature of the invention consists in the fact that an ignition pellet, composed of a suitable quantity of contact substance—such, for instance, as black platinum—and of pure argilaceous earth, is attached to the lower end of the mantle on the inside at a distance at the most not exceeding 3 cm. from the gas-inlet, and that there are connected with the pellet one or more non-combustible ignition strips of suitable composition—the ignition of the gas being effected by these strips, in combination with the pellet.

The inventors say they have ascertained (as the result of experiments extending over many years) that when the ignition strips are composed of ammonium platinum chloride or some analogous compound, the ignition of the mantle is facilitated, while its durability is at the same time considerably increased.

As the experiments made by the inventors demonstrate, the amount of oxygen ordinarily requisite to effect ignition is sufficient also for this purpose in the case of mantles made in accordance with the present invention. It therefore follows that, immediately upon the turning on of the gas, the hydrogen will be ignited without subjecting the mantle to the "injurious detonations" which usually accompany its ignition; the durability of the mantle being consequently considerably increased.

The defects of spontaneous igniters, as heretofore made, are so numerous as to render them of very little use in practice. The ignition pellets, which have usually been located at the upper end of the mantle or suspended on the outside of the mantle, have, for example, heretofore been of a composition unsuitable for promptly attaining the temperature requisite for effecting ignition, with the result that, after the gas has been turned on, a considerable period elapses before the temperature of ignition is attained, and that, when ignition is at last effected, it is invariably accompanied by a more or less violent detonation, the shock of which frequently injures or blows away the pellet. The ignition strips, moreover, in consequence of defective manufacture, usually burn away or refuse to act after a few ignitions, in consequence of which incandescent mantles as heretofore manufactured soon become unsuitable for the purpose indicated.

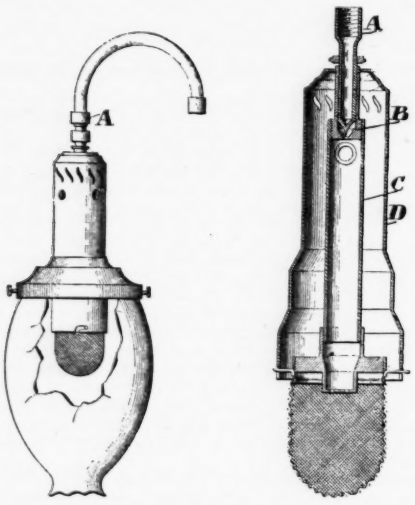
Inverted Incandescent Burners.—Rector, A., of New York. No. 19,468; Sept. 26, 1905. Date claimed under International Convention, May 10, 1905.

This invention consists of the means shown for introducing air into the mixing-tube to mix with the gas as it passes the point of a regulating needle-valve, and of means for increasing and intensifying the light; while at the same time it reduces the consumption of gas.

There is shown (p. 318) an elevation of the burner with globe partly broken away, and a longitudinal sectional view showing the draft or intensifying tube, lateral air-tubes, regulating needle-valve, burner-head, and mantle.

The regulating needle-valve A is provided with a guide-tube, secured to the lower end of which, and integral with it, is a cylindrical cup B, perforated at the bottom; so that when turned to the right it ascends by means of its threaded part and forces the point of the needle-valve into the perforation, and when turned to the left it descends, withdrawing the point from the perforation. The flow of the gas is thus regulated at will. A mixing-tube C has its upper end securely threaded to the cup, so that when it is revolved it carries the cup with it, and causes it to rise or fall, as described. Secured to the lower end of the mixing-tube is the burner-head, with a circular extension or protecting flange to keep it and the mixing-tube from getting too hot, "because if they get beyond a certain temperature it changes the mixture of gas and air, making combustion imperfect." The flange forces the flame through the mesh of the mantle, "brightening it and preventing the flame from coming in direct contact with the burner-head and mixing-tube, keeping them moderately cool." The lower end of the burner-head is provided with a perforated bottom to hold the flame at this point and prevent it flashing-back into the mixing-tube. Surrounding the guide-tube, mixing-tube, burner-head, and protecting-flange is a draught or intensifying tube D, provided at its upper end with perforations, and at its lower end with upper and lower shoulders. The tube is also provided with circular perforations which register with the perforations in the mixing-tube; and the outer ends of the air-tubes pass through these perforations, and are firmly secured therein. The

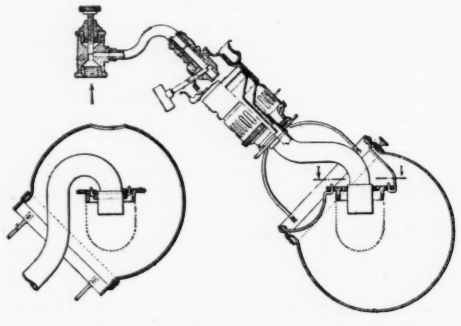
intensifying tube extends upwards to the top of the guide-tube, and is secured, so that when it is revolved the mixing-tube is also revolved—thereby regulating the lamp and controlling the consumption of gas.



The air enters the mixing-chamber immediately below the point of the needle-valve, and, mixing with the gas, "produces a thorough combination before it passes through the bottom of the burner-head." In all other inverted lamps that have come under observation, the patentee says, the air is introduced into the mixing-chamber above the point where the heat passes from the upper framework of the lamp and mixes with the gas. He maintains that hot air from the flame is detrimental to the combustion of the gas by the lamp, as it causes soot to collect upon the burner-head; but, while hot air from the flame is injurious, warm air mixes more readily with the gas, "forming a better compound."

Incandescent Gas-Lamp with Inverted Mantle and Inclined Burner.—Bachner, A., of Berlin. No. 22,708; Nov. 6, 1905.

The present invention relates to an inverted incandescent light with a mantle suspended vertically and a burner directed in an inclined direction downwards or upwards; and it consists in so arranging the mantle and burner, and the globe enclosing the mantle, that the cold air enters the globe through part of the open base, whereby the direction of its flow is substantially the same as that of the gas escaping through the burner. This is said to produce an "undisturbed flame."



The invention also consists in providing an auxiliary air supply for the mixing-chamber consisting of an annular canal (of narrow cross section and of some length) provided around the ordinary mixing-tube; so that the flame will be effectively prevented from striking-back, while at the same time a sufficient amount of additional air will be supplied to the mixing-chamber.

The illustration shows a lamp with a burner inclined downwards, partly in section, and the upper portion of a lamp inclined upwards.

The burner-tube, inclined downwards, is bent in two arcs, so that its mouthpiece is directed vertically downwards; and accordingly the inverted mantle is suspended vertically, and is enclosed by a globe. The result of the inclined situation of the globe is that the air can flow downwards in the direction of the arrows. In the form which has the mixing device and its adjacent part of the burner-tube in an upwardly inclined direction, the curvature of the tube at its end must be different, in order that the mantle may, in this form also, hang vertically.

Forming and Hardening Incandescent Gas-Mantles.—Export-Gasglühlicht Gesellschaft m.b.H., of Neu-Weissensee, near Berlin. No. 24,032; Nov. 21, 1905. Date claimed under International Convention, Dec. 30, 1904.

Known processes for forming and hardening incandescent mantles by machinery are said by the patentees to be more or less defective. Either the forming and hardening of the mantle does not take place uniformly, or an excessive number are damaged and then only form waste. The damage is caused more particularly by the constant turning of the mantle, because, "however exact the adjustment of the apparatus, by the varying heating of its separate parts, these parts are distorted; and thereby, during the constant rotation of the mantle, it is impossible to avoid the latter approaching the burner unequally." This latter takes place to a greater degree as the speed of rotation cannot be reduced below a certain amount, because the current of air is only neutralized when the body is rotated at a certain speed.

The proposal of the present invention—in contrast to a constant rotation of the incandescent mantle, is for each part of the mantle to be moved relative to the flame in a horizontal plane from time to time during the operation—for instance, by intermittent and gradual rotation about its axis. By this periodic or occasional displacement of position of the parts of the mantle in a horizontal direction relative to the flame without its constant rotation, uniform forming and hardening of the incandescent mantles is said to be obtained, while avoiding damaging them.

APPLICATIONS FOR LETTERS PATENT.

9105.—Sugg, W. T., "Flash-light cocks for use in high-pressure gas lighting." April 17.

9111.—Mühlenfels, R. V. C. von, and Lidbeck, G. H., "Closing and opening a gas or liquid current." April 17.

9143.—Stringer, T. H., "Acetylene-generators." April 18.

9193.—Mathes, J. A., "Gas-burners." April 18.

9250.—Chandler, F. A., Bonniksen, B., and Berridge, T., "Automatic apparatus for temporarily increasing the pressure of gas in the mains." April 19.

9307.—Hoseason, J. H., "Mantles." April 20.

9395.—Radcliffe, J., "Treatment of certain products of ammoniacal liquor." April 21.

Wolstanton Gas Bill.

A public meeting to protest against the Wolstanton Gas Bill, which is being promoted in the present session of Parliament, was held last Wednesday week; and after a long discussion, the following resolution was carried: "(1) That in the opinion of this meeting of the ratepayers of Wolstanton, convened by public notice, the installation of a gas-works by the United Urban District Council of Wolstanton is unnecessary, and will not be beneficial to the consumers of gas within the united urban district, who are now supplied in a satisfactory manner, and at a reasonable charge, by the Corporations of Burslem and Newcastle-under-Lyme; (2) that the proposed purchase of the Chesterton Gas-Works and site, and the erection of a new works on that site, is an unsatisfactory scheme, and against the interests of the ratepayers and gas consumers of Wolstanton; (3) that the Chairman be authorized to sign a petition to the House of Commons in opposition to the Bill now before Parliament, and to send copies of this resolution to Mr. J. C. Wedgwood, M.P., Mr. A. Billson, M.P., the Clerk to the Wolstanton United Urban District Council, and the Town Clerks of Burslem and Newcastle-under-Lyme."

Gas to be Cheaper at Leeds.

The Leeds Gas Committee have decided to recommend the City Council to reduce the price as follows: For private consumers, from 2s. 3d. to 2s. 1d. per 1000 cubic feet; for power purposes, from 2s. 3d. to 1s. 10d.; and for automatic meters, from 2s. 6d. to 2s. 4d. In the two former cases there is also a discount, which brings the net price for lighting to just under 2s. per 1000 cubic feet, and that for power to slightly less than 1s. 9d. It is suggested that these modifications shall come into force on July 1. The concessions represent a sum of close upon £25,000 a year. As the concession appears chiefly to favour the manufacturers, it is pointed out that recently suction gas has, in towns where the cost of the ordinary gas is dear, come largely into use; and local firms have over and over again intimated to the Leeds Gas Committee that they should adopt the new method in their works and factories if some concession were not made. In meeting this suggestion with an abatement, the Committee hope they will now run no risk of serious competition; and they remark that they are only doing what has been done by many corporations in other large towns and cities.

Ratepayers and Consumers at Driffield.

Addressing the members of the Driffield Urban District Council at their annual meeting last week, Mr. Shepherdson referred at some length to the gas undertaking. He remarked that the Council were often advised "to consider the ratepayers;" and apparently there were many people of the opinion that the ratepayers did not receive the consideration to which they were really entitled. He had always argued that the Council ought not to charge the consumers very much more than it costs to produce the gas; but the Council did charge an excessive price, with the result that the ratepayers were relieved from a burden which they ought to bear. This was an injustice to the consumers; and he thought the Council should ask the Gas Committee to take into consideration an immediate reduction in price from 3s. 4d. to 2s. 11d. per 1000 cubic feet. Probably this reduction would not satisfy the whole of the consumers; but it was a step in the right direction. He would suggest that the reduction should take place as from July 1. Mr. Gibson, on the other hand, objected to such a recommendation going forward from the Council. He was strongly opposed to the principle; and contended it was unfair to recommend or to make such a reduction until every householder was made a direct contributor to the rates. He was in favour of the Committee taking into consideration a reduction of the price of gas, but leaving out the specific sum named by the mover. The amount was then struck out of the motion, and it was carried.

The Petersfield Rural District Council have approved of a gravitation scheme of water supply prepared by Mr. Harry W. Taylor, for the parish of Liss. The water will be obtained from copious springs on the chalk outcrop; and the parish will be supplied by gravitation, at an estimated cost of £6500.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by Correspondents.]

Working of Retort-House Governors.

SIR,—Mr. Helps's letter in your last issue is one with which most gas engineers would, I think, agree; but though Mr. Wilson's figures are open to grave questions, it does not necessarily follow that the principles underlying the adoption of retort-house governors are false.

Immediately after reading Mr. Wilson's paper on "Retort-House Governors," I wrote Messrs. Parkinson and Cowan on the matter; and I enclose a copy of this letter. It may, perhaps, be of some interest to your readers, as it dives somewhat into the principles underlying the efforts to facilitate the passage of gas from the retorts to the foul main—that is, to offer no opposition whatever to the free discharge of the gas, but, on the other hand, to encourage it to leave the coal freely, and yet exclude all furnace gases.

71, *King William Street, E.C., April* 25, 1906. F. S. CRIPPS.

[COPY OF LETTER SENT TO MESSRS. PARKINSON AND COWAN.]

April 20th, 1906.

I have read Mr. Wilson's paper on your new governors for controlling pressure in hydraulic mains, and have jotted down the following thoughts which occurred to me on reading it.

Your governor maintains one even pull on all hydraulic mains. But retorts newly charged vomit more gas than just before drawing; and therefore the pressure in a retort may be greater when newly charged than when nearly exhausted—due to frictional resistance to the quantity of gas passing the ascension and dip pipes and overcoming the seal, however slight.

The only perfect arrangement would appear to be free egress for the gas from the retorts and through large pipes into a hydraulic main having no seal.

If the governor only maintains an even pressure in the hydraulic main for newly-charged and exhausted retorts alike, then it is under-aiding the one and over-aiding the other, as all are "tarred with the same brush"—that is, all retorts over which the governor has control.

If the same governor were placed at the outlet end of the foul main, or even at the outlet of the condenser, the same effect should be maintained, or nearly so. At the present time, gas is drawn direct through the exhauster; but if a governor were placed just in front of the exhauster and all gas drawn through it, there would still be the same, or very nearly the same, effect as putting it on the retort-bench.

What we all aim at is to get an even exhaustion of gas from the coal at every moment of its life in the retort; so that, on the one hand, there shall not be the ghost of a pressure in the retort, nor, on the other hand, the barest suspicion of a vacuum. Theoretically, this could be obtained by having a governor on every retort. Then, as the yield fell off and the consequent effort to produce pressure in the retort relaxed, the governor would gradually close down at the same rate until, when there was no gas whatever being ejected from the coal, the governor would close altogether. But, of course, such a thing is impracticable. The best we can do is to group the retorts and strike averages, by putting a governor to so many, when it is obvious gas producing and non-producing retorts are served all alike.

I have said the effect would be practically the same if we put a governor close up to the exhauster as putting it on the retort-bench. The difference, however, is this: The closer the governor is to the retorts under control, the less is the volume of gas lying between them and the governor. Now, if the pressure increases in the retort by reason of a larger quantity of gas being suddenly ejected, this extra quantity takes effect on the governor immediately, if the governor is close to it; but if it has to make itself felt through the medium of a large volume or cushion of gas lying between the retort and the governor, it has to do so by raising the pressure of the whole bulk, which necessarily takes more time and is less sensitive—the rise in pressure of the whole bulk being so much less than in the actuating quantity only if it could but be made to actuate the governor direct without any intervening volume of gas.

Placing the governor on the retort-bench instead of at the inlet of the exhauster is therefore only a step nearer home. We still have in the same bed some retorts newly charged, some nearly exhausted. Those that are hard at work are levelled down by those which are idle or nearly so.

It is not practicable to charge all the settings in one bed at one time, nor to switch on the newly-charged ones to one governor and the exhausted ones to another. They must all be treated alike, although to get perfection of working and maintain the pressure in all retorts at zero, we should properly pull with a vacuum of perhaps 5-10ths in one ascension-pipe and only 1-10th in another.

What then is to be done? What conclusions can be drawn?

(1). There should be the greatest possible freedom for gas to leave the retort. It should not be choked up with coal.

(2). The ascension and dip pipes should be large enough to allow the maximum quantity of gas passing without offering any appreciable resistance from friction, even allowing for slight obstruction from tar, pitch, &c.

(3). There should be no seal, but, if possible, a zero pressure in the hydraulic main and right away to the governor, wherever it may be put, which means

(4). The foul and cooling mains must be large enough to offer practically no frictional resistance, or as much of them as come between the retorts and the governor.

(5). A device is necessary for temporarily sealing the dip pipes belonging to such retorts as are being charged only.

Mr. Rigby's Paper on Power-Gas Plants.

In the "JOURNAL" for the 17th ult., we published some extracts from a paper on "Power-Gas Plants," read by Mr. T. Rigby, of Messrs. Crossley Bros., before the Engineering and Scientific Association of Ireland, and in connection with it gave an illustration (p. 167) of a Mond gas plant, to which reference was made in the text. Mr. Kenneth Crossley asks us to point out that the actual plant described by Mr. Rigby was of their own design, and on an entirely different system from the Mond ammonia-recovery plant; and that the illustration given was of the plant in their own works.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills read a second time and committed: Accrington District Gas and Water Board Bill, Holyhead Water Bill, Mirfield Gas Bill, North Sussex Gas and Water Bill, Wolstanton United Urban District Council Gas Bill.

Bills read the third time and passed: New Mills Urban District Council Bill, North-East Lincolnshire Water Bill, Thornton Urban District Gas Bill, Uxbridge Gas Bill.

The Chairman of Ways and Means informed the House last Tuesday that, in his opinion, the Wandsworth and Putney Gas (Removal of Sulphur Restrictions) Bill, though unopposed, ought to be treated as an opposed Bill. It was accordingly referred to the Committee considering the Gas Companies (Removal of Sulphur Restrictions) Bill, whose proceedings are reported elsewhere.

The Ascot District Gas (Electric Lighting) Bill has been referred to a Select Committee, consisting of Mr. Nussey (Chairman), Major M'Micking, Mr. Beckett, and Mr. Patrick White; to commence their sittings to-day.

The Metropolitan Water Board Bill, South Metropolitan Gas Bill, South Suburban Gas Bill, and Sutton, Southcoates, and Drypool Gas Bill, have been referred to a Select Committee, consisting of Major Seely (Chairman), Sir Robert Hobart, Mr. F. W. Hervey, and Mr. Macpherson; to meet on Thursday.

Petitions have been presented against the following Bills: Shrewsbury Corporation Water Bill, from the Shrewsbury Gas Company; Wolstanton United Urban District Council Gas Bill, from the Newcastle-under-Lyme and Burslem Corporations and consumers of gas in Wolstanton.

Petitions presented against the following Bills have been withdrawn: Cheltenham Gas Bill, by the Cheltenham Corporation; Derby Gas Bill, by the Draycott Gas Company and the Derby Corporation; Gas Companies (Removal of Sulphur Restrictions) Bill, by the Hastings, Ipswich, Shrewsbury, and Wolverhampton Corporations, and the Hampton, Harrow, Wealdstone, and Wembley Urban District Councils; South Lincolnshire Water Bill, by the Black Sluice Commissioners; Southampton Gas Bill, by the Southampton Corporation; Tottenham and Edmonton Gas Bill, by the Middlesex County Council and the Great Eastern Railway Company.

REMOVAL OF SULPHUR RESTRICTIONS BILL.

House of Commons Committee.—Thursday, April 26.

(*Before Mr.* F. CAWLEY, *Chairman, Mr.* ROWLAND HUNT, *and Mr.* DUDLEY WARD.)

This Bill, which seeks the withdrawal of obligations regarding the removal of sulphur impurities from gas, is promoted by fourteen different Gas Companies.

Mr. ERNEST MOON, K.C., and Mr. C. C. HUTCHINSON appeared for the promoters; Mr. HONORATUS LLOYD, K.C., and Mr. E. SHORT represented the Newcastle-on-Tyne Corporation. Other petitioners who were not represented by Counsel were the East and West Molesey Urban District Council, the Hampton Urban District Council, the Hebburn-on-Tyne Urban District Council, and the Gateshead Corporation.

Mr. MOON, in opening the case, said that the promoters of the Bill were fourteen Gas Companies in various parts of the kingdom. Passing immediately to deal with the point in question, he said that sulphuretted hydrogen could be got rid of from crude gas by the use of a very easy and simple process, and without any undesirable results to those people who might be in the neighbourhood of the works; but if they wanted to go beyond this, and get at the other sulphur compounds, the only known means was by using lime purification. This did not get rid of the whole residuum of sulphur; but it removed part of it. For some reason or other, it was at one time thought desirable for some of the gas companies to be placed under obligation to remove the sulphur compounds; but in many instances there was more sulphur left than (say) 30 or 35 grains for every 100 cubic feet of gas. In all the cases to which this obligation applied, the companies had to employ lime purification. This obligation had never been made where a company were authorized by Provisional Order, because the Board of Trade had never thought it necessary to insert the provision. Since 1860, when the sulphur clause was first heard of, out of 738 companies, only 44 had been placed under the restriction; while 233 belonged to local authorities, in whose opinion such an obligation was unnecessary, and who had in some cases applied to Parliament to have it removed. He thought that it was admitted on all hands, except by the Newcastle Corporation, that it was useless to so purify the gas, either from the point of view of health or from that of the preservation of property. The lime process gave off such an awful stench that it was disgusting to everybody in the neighbourhood. Then, again, the lime had to be taken away through the streets; and this was also responsible for a horrible smell. The process was a difficult as well as a delicate one; but if

the gas was not purified up to a certain point, the company were liable to a penalty of £5 or £10. The result of all this was that for years past gas companies and local authorities had been applying to Parliament for the repeal of the sulphur clauses which the companies for whom he appeared were now asking to have withdrawn. The case of the London Gas Companies was thought to be of such public importance that, instead of the matter really going to a Private Bill Committee, a Departmental Committee was appointed by the Board of Trade to bear evidence, and practically determine the question whether, in the public interest, it was safe and desirable to permit the repeal of the restrictions.

The CHAIRMAN asked Mr. Lloyd whether he had any new evidence to bring forward beyond that given before the Departmental Committee.

Mr. LLOYD replied that he hoped to be able to put before the Committee scientific evidence showing what results had been arrived at.

The CHAIRMAN: Perhaps that may be fresh evidence; but I may tell you that, as far as I am concerned, we shall have very great difficulty in coming to a decision the reverse of that arrived at by the Departmental Committee.

Mr. LLOYD replied that in this case there were distinct differences. Different conditions prevailed in different places. The Departmental Committee had no evidence whatever from the Provinces; and conflicting statements were made.

The following evidence was then given.

Mr. *W. Doig Gibb*, Chief Engineer to the Newcastle-on-Tyne and Gateshead Gas Company, examined by Mr. HUTCHINSON, said that his Company made over 3000 million cubic feet of gas per annum; the district supplied covering an area of some 127 square miles. The provisions contained in their Act of Parliament with reference to the combined sulphur were, that for gas supplied within the city of Newcastle-on-Tyne and the borough of Gateshead they were limited to 20 grains, with penalties if they exceeded this amount. For all the rest of their district, including Hebburn-on-Tyne, they had never had any restrictions. In the North of England, the only two Companies who were subjected to sulphur restrictions were Newcastle-upon-Tyne and Walker and Wallsend. With regard to purification by lime, his Company used lime entirely for the removal of sulphur; but it was a most uncertain material to work with. It was not found to be reliable in all cases; and it very quickly became foul. Even with the greatest care it was not possible to obtain a uniform quality of gas, having regard to the number of grains of sulphur that it contained. The process of emptying purifiers was a very disagreeable one for the workmen. If they had any broken skin which was brought into contact with the foul lime, wounds healed with difficulty, and there was a danger of blood poisoning. He agreed that by using oxide of iron they could completely stop the use of lime.

Mr. HUTCHINSON: What effect would that have upon the combined sulphur? Anything like the effect of lime?

Witness: It takes out all the sulphuretted hydrogen quite as well as lime; but there is a part of the other sulphur impurities—an impurity called bisulphide—which oxide of iron does not act upon; and it is this which would come through with the gas if oxide only were used.

In the course of Mr. Lloyd's cross-examination,

The CHAIRMAN said: I do not want you to be at the trouble of producing any evidence to rebut the evidence adduced before Lord Rayleigh's Committee, because that Committee have admittedly more weight than we, as an ordinary Committee of the House of Commons, can have in matters of this sort; and we should not set our opinion against the opinion of such eminent men as those who composed that Committee.

Mr. LLOYD: That was a Departmental Committee, who heard witnesses of whom there was no cross-examination of any kind. Witnesses wrote out statements, which were handed in and read; and then some of the members of the Committee asked questions. They have said that, notwithstanding the fact of the absence of restrictions in many districts, there have been no complaints. As a matter of fact, they were dealing with the Metropolis. Nobody from the Provinces had *locus standi*, or could have made any complaint. If, therefore, a Committee hampered in that way, with no cross-examination, and limited to a particular reference, are to be taken in their conclusions as binding before a tribunal which can have cross-examination, and can have other people before them, the result is that I am bound by a decision in respect of a matter upon which I could not be heard.

The CHAIRMAN said his object was to shorten the evidence, because any amount of scientific evidence brought before them would not have very much weight; and he did not think he could advise his colleagues to set themselves up against the opinion of those people who were appointed for the express purpose of getting the opinion of scientific witnesses on a scientific subject.

Mr. LLOYD said that if the Committee told him that, having regard to the constitution of the report of that Committee, he was to assume that the Committee would apply that decision to Newcastle, of course, inasmuch as he was only there to urge that this should not be done in Newcastle, it left him with absolutely nothing to say.

The CHAIRMAN remarked that if Mr. Lloyd could bring fresh evidence that applied to Newcastle alone, their duty was to hear him.

Mr. LLOYD: I propose to show you that Sir George Livesey, who gave evidence on more than one occasion before that tribunal, told them that, with the information at his disposal, if they did away with the sulphur restrictions, the effect would be that the average amount that the Londoner might expect of sulphur compounds in his gas would be 35 grains per 100 cubic feet, and that it would not exceed 40 grains. Now we find that his Company—whether he has been using cheap sulphurous coal or not—has, since the abolition became effective, gone up to 78 grains.

The CHAIRMAN: What do you consider is the amount that is injurious to the consumer?

Mr. LLOYD: I suppose everybody would differ about that; but I do not think that anybody will differ about this—that if it gets up to 70, it is mighty unpleasant. If it reaches 80, it is more than unpleasant; but these people have themselves supplied a maximum of 78·5 grains and an average of 47·4 grains. (To witness:) Durham coal varies considerably in its quality, does it not?

Witness: Over the whole field.

What percentage of sulphur is in the coal you use to-day for gas production?—In the solid coal, it is roughly about 0·53 per cent.

You at present use a class of Durham coal which has a low percentage of total sulphur; and if you get rid of these sulphur restrictions, there is a cheaper Durham coal with a higher proportion of sulphur which you can use?—I do not think so.

Mr. *A. B. Walker*, the Engineer of the Walker and Wallsend Gas Company, said he had heard the evidence of the previous witness with reference to Newcastle, and he adopted it in regard to the Walker Company. He did not think the sulphur restrictions were necessary in the interests of the consumers.

Sir *George Livesey* said that, in the public interest, he regarded sulphur restrictions as totally useless. They were doing no one any good, gave no end of trouble, and caused great nuisance and inconvenience to the neighbours of the gas-works without one iota of benefit to the public. They had found considerable advantage in not having to deal with lime purification, and nearly all complaints of nuisance had ceased. The position of the Newcastle Company and the London Companies might be said to be identical; for they both used the same coal. What was good for London was surely good for Newcastle.

Mr. LLOYD: When you were giving your evidence before the Departmental Committee, you were under the impression that it would be safe to take it, if the restrictions were done away with, that it would not be over 40 grains, and, over the average of a month, not over 35?

Witness: That was the basis. I was Chief Officer of the South Metropolitan Company from 1870 to 1874—when we first came under the Referees. The Metropolitan Board of Works made daily tests of the gas for sulphur; and the result was that the highest test in those three or four years, out of many hundreds of daily tests, was 42 grains, the lowest 28, and the average a little under 35. On the strength of this, I told the Departmental Committee that I believed the amount of sulphur would always be under 40 grains.

As a matter of fact, it has turned out that the percentage is considerably higher?—Yes, it has.

Your averages have run up in some cases to 47·4?—The fact is that I felt the matter of such absolute unimportance that I have not looked into what the averages were. I have known what the excesses were, some of them. The highest, I believe, was 75 grains.

I have 78?—That is near enough.

Continuing, witness said that he fully believed the average would be about 35; but there were reasons why it was not. One was that the engineers and the workmen had got entirely out of the use of oxide of iron purification. They had had to get fresh supplies of oxide; and it would be a matter of experience to find out which was the best. They did not know the proper conditions of moisture and dryness and all that; but they would acquire that in time. Then they had fancied their excesses of sulphur seemed to come oftener on Mondays. They stopped working for the benefit of the men on Sunday; and, sulphur or no sulphur, they meant to keep this up. This interfered with the regular production of gas. They were investigating all these things, and he had not the slightest doubt that they would find various mitigating causes, and get the sulphur down to what he said it would be.

The CHAIRMAN: What were the tests imposed for, to start with?

Witness: It was a chemist's fad and nothing else.

In reply to another question by the CHAIRMAN, regarding the use of incandescent burners, witness said that with these burners very often this has happened: In a sitting-room with five ordinary burners, consuming 25 feet an hour, they will put on one incandescent burner, and that will give as much light as they want, and burn only 3 or 4 feet of gas an hour.

The CHAIRMAN: It is the smaller amount of gas consumed by the incandescent burner, not that the incandescent burner gives off less sulphur than the flat-flame?

Witness: That is all.

Professor *Vivian B. Lewes*, the Chief Superintendent Gas Examiner to the Corporation of the City of London, stated that if in 75,000 cubic feet of gas he had consumed during the past three months there had been 78 grains of sulphur, it confirmed him in the idea that the purification of gas from the sulphur compounds other than sulphuretted hydrogen was absolutely needless, because he had not found the slightest discomfort in the smell from sulphur compounds. He was quite sure that the nuisance from lime purification was enormously greater than any other nuisance or damage which did or could arise from leaving this very small trace of sulphur compounds in the gas.

Mr. LLOYD: How many grains of sulphur compounds other than sulphuretted hydrogen could you take out by oxide of iron?

Witness: A very small amount indeed. It might be 4 or 5 grains, or something of that sort.

Let us look at a practical example. Take the case I gave Sir George Livesey, where the maximum got up to 78 grains. That was either after he had treated with oxide of iron, or after he had used some other substance, or both?—Both probably.

If he eliminated the lime, do you say he might get a better result?—Yes; if some of his bisulphide was coming from a foul lime purifier.

Do sulphur compound impurities arise from other matters—for instance, carelessness in the work sometimes?—Undoubtedly they do.

For instance, if the condenser is not properly attended to, or not used, and the gas is turned straight in, would this have the effect of raising the proportion of sulphur?—Yes. There are a hundred-and-one things of the sort which would do it.

Mr. LLOYD then briefly addressed the Committee on behalf of the Newcastle-on-Tyne Corporation, and said they should let London go on as it was going on, at the expense of the consumers; and if it turned out that Sir George Livesey could reduce the amount of compounds, and could get back to what he expected would be the result, then would be the time for the Provincial Companies to come along and ask for the abolition of the tests. The whole matter was in an experimental stage—experiments which had resulted in a manner which they had not expected. Such a thing ought not to be applied to Newcastle.

Mr. *John Pattinson*, analytical chemist, of Newcastle-upon-Tyne, was the first witness for the opposition. He said that he and his partner, Dr. Dunn, had made experiments to ascertain the effect of burning gas on the air in a room. They used two rooms; one being 3200 cubic

feet in size, and the other 3400. The doors and windows were closed; but the fireplaces were not blocked in any manner. On its way to the meter, the gas was allowed to take up a certain quantity of the vapour of carbon bisulphide. In the first series of experiments, a single burner was used, and each experiment lasted about two hours. Some 10 cubic feet of gas were burnt. In thirteen experiments, the amount of sulphur in the gas varied from 30 to 80 grains per 100 cubic feet of gas. Upon entering the room at the end of two hours, the smell of sulphur dioxide was found to be always distinguishable, though in the case of gas containing 30 grains it was not easily recognizable in the lower parts of the room. With 40 grains of sulphur, the smell was quite distinct and unmistakable in every part of the room. When the sulphur reached 70 or 80 grains, it was very strong. In none of the comparison experiments with ordinary Newcastle gas containing 8 to 10 grains, could the taste or smell of sulphur dioxide be distinguished, though, on entering the room, the odour of burnt gas was perceived. There seemed little doubt, however, that the peculiar smell of burnt gas was due to the sulphur which it contained; for a room in which an equivalent amount of good paraffin oil had been burnt, produced quite a different sensation. Two experiments were also made in which three burners were used, and the amount of sulphur in the gas was 34 to 35 grains per 100 cubic feet. In both cases, the smell of sulphur dioxide was very strong; but where Newcastle gas only was burnt, the room felt very stuffy, and the fumes of burnt gas were at once recognizable, though there was no perceptible smell of sulphur dioxide.

Witness, in reply to questions by the CHAIRMAN, said that 40 grains were more harmful than 20 grains; and he found that from 30 to 40 grains were very unpleasant to breathe. If a workman lived continually in such an atmosphere, it was very likely indeed that his health would suffer. He suggested that the Committee should allow the Bill to go through, subject to the amount of sulphur not being more than 40 grains; but he should prefer to have gas of the quality with which they were now supplied.

Mr. *Edmund H. Stevenson* said that, generally speaking, men employed at gas-works were among the most healthy in a town; and, in fact, he had known children who were suffering from whooping cough to be brought to gas-works to be treated, in the good old days when the purifiers were really foul. By the removal of restrictions, there was harm to fittings; and there might be harm to health, with an excessive quantity of sulphur, by lowering the vitality of the people.

In cross-examination by Mr. MOON, witness said he had given evidence in favour of the removal of these restrictions in the South Shields case; but if he had thought there was any serious risk of danger to health, he should not have advocated it for a moment. When, however, he gave that evidence, he did think with Sir George Livesey that the sulphur would not rise above 35 to 40 grains at the very outside. Now, when he saw it rise up to nearly 80 grains—and it had been higher in the earlier experimental stages—he was doubtful whether it was wise to take off all restrictions. He did not know that it would be necessary to use lime to keep the sulphur at the 40 grains mentioned by Mr. Pattinson.

The Committee then adjourned until yesterday (Monday).

Monday, April 30.

On the resumption of the proceedings to-day,

Professor *Percy F. Frankland*, F.R.S., was the first witness; and, in answer to a question by the Chairman, he stated that he was not prepared to say how many grains of sulphur per 100 cubic feet of gas he considered to be unpleasant.

Dr. *Armstrong*, the Medical Officer of Health for Newcastle, spoke of the destructive effects of gas upon books, instruments, and materials, besides giving the results of experiments of burning gas in rooms, and ascertaining the amount of sulphur which it contained.

Mr. *W. J. A. Butterfield* stated that sulphur in gas was generally disagreeable to persons in gas-lighted rooms. He also spoke upon the effect of sulphur in gas upon two inverted gas-burners which he had had under observation for some considerable time. In reply to questions by the Chairman, he said that there should be some restriction upon the quantity of sulphur allowed, and he suggested that it should not be more than 40 grains, with a maximum of 50 grains.

The CHAIRMAN (to Mr. Moon): Will you accept that?

Mr. MOON: We cannot accept it.

After a short adjournment, the Committee decided that the preamble of the Bill was proved.

Having regard to this decision, the Wandsworth and Putney Gas Bill, which was also promoted with the same object as the Bill just disposed of, was withdrawn.

Power Consumers and Ratepayers Benefit at Huddersfield.—The net profit on the past year's working of the Huddersfield Corporation gas undertaking amounts to £17,634, and this notwithstanding a reduction in the price of gas for lighting and heating purposes since the beginning of 1906. It is proposed to reduce the price for motive power and business purposes to 1s. 6d. per 1000 cubic feet as from the commencement of April. From the profits of last year, an amount equal to a 2d. rate will be handed over. The water-works show a loss of £6336.

Carlisle Gas-Workers' Agitation.—The Gas Committee of the Carlisle Corporation have so far failed to come to an arrangement with their stokers, engine men, carburetted water-gas employees, and other workmen, in regard to the agitation for improved conditions of labour and better wages (*ante*, p. 193). A few days ago, Mr. Lynas, the District Secretary of the National Union of Gas Workers, had an interview with the Committee on behalf of the men. They made an offer of certain concessions to several sections of the men; but declined to change the offer already made to the stokers. The men afterwards held a meeting to consider the modified terms; and they decided not to accept them, in consequence of no further concessions having been offered to the stokers.

LEGAL INTELLIGENCE.

CLAIM REGARDING A GAS ESCAPE AT STALYBRIDGE.

His Honour Judge Reginald Brown, K.C., sitting at the Ashton County Court, has just decided a case in which John Wilson, a cotton spinner, and his wife claimed £3 13s. 9d. from the Stalybridge Corporation for damages alleged to have been caused through their negligence in allowing leakage from a gas-main adjacent to the house.

The circumstances of the case, as explained by Mr. Ives, who appeared for the plaintiffs, were that on Feb. 16, in the early morning, Wilson and his wife and children all awoke about half-past four with a severe headache. One of the boys got out of bed, and commenced to be sick; and a few minutes later two of the girls were seized with a fit of vomiting. Mrs. Wilson complained of a violent headache; and Mr. Wilson, suspecting something, got up and went downstairs. As he proceeded, he became very faint; and when he had passed through the kitchen into the house, he fell senseless to the floor. Half-an-hour later, he recovered somewhat, and noticed a powerful odour of gas. Such was the effect upon the family that Dr. Clifford ordered their removal from the house for the week-end, in order that they might recuperate. Householders in the vicinity had also smelt the gas; and Mrs. Power, a near neighbour, on going into the yard early one morning, was quite stupefied by the fumes. Complaints had been made to the Corporation, as the owners of the gas-works; and a new main was afterwards put in the whole length of the street. It had been suggested that it was sewer gas; but Dr. Clifford declared that all the effects pointed to it being coal gas. Mr. Ives wished to show that there was negligence on the part of the Corporation; and he said that the fact that the escape affected three houses, put him in a strong position. Only a fortnight before the accident, Mrs. Wilson complained strongly to the meter-man; and he tested the meter, but found nothing wrong. Mr. Ives submitted that it was the man's duty to find whether the escape was inside or outside, and to report to headquarters.

For the defendants, Mr. Pope submitted that it was necessary for the plaintiffs to prove actual negligence, as the escape might have arisen from causes not preventable.

Evidence on both sides having been given,

His Honour, in finding for the Corporation, said the plaintiffs had failed to show that the defendants were guilty of any default in the execution of their duty in taking reasonable care with regard to the gas-pipes in the street, either by want of examination or relaying at the proper time, or by not attending to the complaint made with regard to the alleged escape.

Mr. Pope said the defendants did not ask for costs; but when a general charge of negligence was made, they thought they should defend themselves, and publicly disprove the allegation.

A Mainlaying Case in New Zealand.

In the Auckland (N.Z.) Supreme Court, on March 6, his Honour Mr. Justice Edwards delivered judgment in a special case between the Auckland Gas Company, Limited, and the Mayor, &c., of the Borough of Grey Lynn. His Honour said that, after the Gas Company had had a map prepared, but before certain streets of the borough were formed to their proper level, the Company laid down gas-pipes. The pipes were laid without any interference or objection from the Corporation, who were given notice of the Company's intention. In March, 1904, the Corporation gave the Company notice to alter the gas-pipes in certain streets, in accordance with the work being done in forming the streets to the permanent levels. The Company protested against being made liable, but altered the gas-pipes at a cost of £282. The question was whether the Corporation should repay the cost incurred by the Company. The three Municipal Corporations Acts of 1876, 1886, and 1900 provided that, "all buildings erected within the borough, and all private streets, should be constructed with reference to the levels shown upon the said map." There was no such provision with reference to the laying of gas-pipes, and such a provision would be unworkable. If the Corporation did not choose to exercise their powers of control, the Company were at liberty to perform the work specified in the notice to the Corporation without superintendence. This was what happened. In the Acts relating to municipal corporations, the Legislature had apparently taken the view that local bodies might conserve their interests by exercising the powers of control; but if any alteration was found necessary, it must be carried out at the expense of the ratepayers. The Company were therefore, in his opinion, entitled to recover from the Corporation the sum of £282 mentioned in the special case. The costs, by agreement, were fixed at £10 10s. and disbursements, to be paid by the Corporation.

Burglar and Prepayment Meter Thief Gets Penal Servitude.

In the High Court of Justiciary in Edinburgh last Friday, Lord Dundas had before him a young man who was charged with twenty acts of theft by housebreaking—including six or seven acts of theft from prepayment gas-meters. The offences were mostly committed in Dundee, between the 12th and 29th of March. Woods pleaded guilty. Lord Dundas said the prisoner had owned up to a large number of offences, and he saw that he had only just been out from a previous sentence when he chose to set about wrong-doing again. There were a large number of previous convictions against him, of various kinds, and the least he could give now was a sentence of five years' penal servitude.

An acetylene street-lamp at Denshaw, Saddleworth, exploded last Sunday week, and injured a lamplighter and a friend to whom he was talking.

MISCELLANEOUS NEWS.

THE EXAMINATIONS IN GAS MANUFACTURE.

The City and Guilds Question Papers.

The examinations in "Gas Manufacture" conducted by the Department of Technology of the City and Guilds of London Institute were held last Saturday; and we give below the questions set by Mr. A. F. Browne, the Superintendent of the Vauxhall station of the South Metropolitan Gas Company, who has succeeded Dr. Harold G. Colman as the Examiner.

HONOURS GRADE.

1.—Show that the total quantity of hydrogen present in a sample of coal is not realizable in gas making. Calculate the quantity so available in the case of a coal having the following percentage composition:—C, 85·58; H, 5·31; O, 4·39; and N, S, and ash, 4·72. What percentage of available hydrogen should a good gas coal contain?

2.—Give a short account of the Dellwik blue water-gas plant, showing how it differs in design from a carburetted water-gas plant. Contrast the time occupied by the two plants in the operations of "blowing up" and "running." Since one plant requires more coke per 1000 cubic feet of water gas produced than the other, show that the difference is usefully consumed.

3.—In erecting settings of horizontal retorts to be operated by machinery, state the position in which you would prefer to place the producers, giving practical and economic reasons. Show how the question of recuperation would be affected by the position chosen. State the grate area you would specify, showing how you arrive at it. Mention any purely mechanical difficulty attendant upon the distribution of gas from producers at a distance.

4.—Specify objects, other than cooling, designed to be effected in gas condensation. Mention mechanical means which have been adopted or proposed for the attainment of such ends. What is meant by the "counter-current," and what is that function of the condenser which in recent practice has devolved upon, or been supplemented by, other apparatus? Of the total heat removed in cooling coal gas from 140° to 60° Fahr., about 13 per cent. is given up by the permanent gases; from what is the remaining 87 per cent. derived?

5.—In a rotation of four purifiers, each box is 1072 square feet in area by 5 ft. 3 in. deep. It is fitted with four tiers of sieves, each carrying a layer of oxide of iron 9 inches thick. State the maximum daily quantity of gas which the set (with the aid of catch-boxes) is competent to purify from H_2S (say, 350 grains per 100 cubic feet). Give your basis of calculation and an authority for it.

6.—The area of a purifier cover is 1068 square feet, the depth of the water-seal is 30 inches; calculate the total pressure in pounds to which the cover would be subjected if the outlet-valve were improperly closed, and state what risk would be involved. What would probably happen in the absence of a water-lute? How would you provide against either risk? Sketch in section Green's purifier crown and cover.

7.—A gasholder-tank is 200 feet in diameter and 50 feet deep; What is the total force of the water tending to overturn the wall? Specify, in order of importance, the number and nature of the resistances opposed to this force. Sketch in section, and explain the use of, the Livesey gasholder manlid.

8.—What is the function of the pressure-raiser in gas distribution? Describe shortly any such apparatus working between pressures measurable in inches head of water. State the most recent developments in this direction.

9.—Define the meaning of the expression "intrinsic luminosity of gas," and state the conditions under which a gas must be consumed for its full development. Show that the conditions requisite to secure the best lighting effect from the same gas by means of an incandescent mantle are totally destructive of intrinsic illuminating power. With what quality of the gas supplied to it does the luminosity of the incandescent mantle vary?

10.—What is the mechanical equivalent of a British thermal unit, and what number of such units are required to develop one theoretical horse-power-hour? Assuming that a steam-engine consumes 14,130 units per brake-horse-power-hour, a gas-engine 10,176 units, and an oil-engine 9120 units, state the heat efficiency of each.

ORDINARY GRADE.

1.—Of what material were the first gas-retorts made, and what were the reasons which led to the rejection of that material in favour of "brick" or "clay" retorts? Give sketches of three shapes of fire-clay retorts in common use; figuring upon them their usual dimensions and thickness, and stating the various positions in which they may be set. Explain the meaning of the terms "single" and "through," descriptive of retorts.

2.—Explain the difference between "direct firing" and "gaseous firing" as employed in gas-works, and show why gaseous firing consumes less coke per ton of coal carbonized, since 1 lb. of carbon, whether burned at once to CO_2 or to CO first and then to CO_2, can only generate 14,500 British thermal units. Explain the meaning of the term "recuperation" as applied to retort firing.

3.—Describe shortly an apparatus in common use for the analysis of furnace gases, specifying the reagents employed for absorption of O, CO, and CO_2. In the event of discovering too much CO_2 in the unburnt gas, or an excess of O or a trace of CO in the chimney gas, how would you put matters right? What percentage of CO_2 should be found in the chimney gas resulting from the combustion of a producer gas having the following composition per cent. by volume: H, 6; CO, 29; CO_2, 4; N, 61.

4.—Give a simple sketch, in cross section, of any retort-setting with which you are acquainted containing a combustion chamber, and state the reasons for the employment of such chamber when gaseous firing is adopted.

5.—Describe briefly the plant employed in the manufacture of carburetted water gas, explaining the object and working of each portion of the apparatus. Sketch, in sectional elevation, any one portion of the plant.

6.—State the purpose for which the exhauster is employed in gas-works, and show the effect of working without it (1) upon the make of gas per ton, and (2) upon the quantity of fuel required to heat the retorts. Mention the means adopted in the engine-room and in the retort-house to guard against the production of a partial vacuum in the ascension-pipe, stating the effect of such an occurrence upon the quality of the gas with the retort-lid (1) shut and (2) open.

7.—Specify the various materials of which gasholder tanks are constructed, and state the means by which they are made water-tight when built of porous materials. Sketch a gasholder cup and grip in contact.

8.—Specify the two impurities from which it is necessary that town gas should be clean, and describe briefly the apparatus and materials employed for their removal, showing that this can be effected easily and without nuisance. Mention the simplest and readiest tests for the detection of these impurities in a sample of gas.

9.—Describe a gas-calorimeter, and explain its action. Distinguish between the terms "gross" and "net" (or "upper" and "lower"). Give a reason why the calorific intensity or actual flame temperature of a 600 B.T.U. coal gas is lower than that of a 330 B.T.U. blue water gas.

10.—A translucent photometer screen is equally illuminated at a point situate 49·8 inches from a gas-flame and 39·37 inches from a standard of light. Calling the standard light 1, or unity, calculate the comparative value of the gas-flame, showing your working, and stating the answer both in figures and words.

The candidates had to confine themselves to one grade, and they were advised not to attempt to answer more than eight of the questions in the four hours allowed. In the honours grade, 39 marks were given for Nos. 5, 6, 7, 9, and 10, and 36 for the others. In the ordinary grade, the higher number of marks was given for Nos. 3, 4, 5, 9, and 10.

The Polytechnic Question Papers.

The following were the questions set at the Polytechnic, Regent Street, where the classes in "Gas Manufacture" are conducted by Mr. Walter Grafton, F.C.S., at the examinations held on the 11th ult:—

HONOURS GRADE.

1.—Give sketches showing the construction of a bed of 10 retorts (21 in. by 15 in.) heated by producer gas, and state what should be the approximate composition of the gaseous fuel and the depth of coke necessary in the furnace to practically maintain the same.

2.—Fully describe the "D.B." projector, and its advantages over other charging-machines. What quantity of coal per six hours is considered the most economical charge? Give the yield of gas and residuals per ton of coal carbonized.

3.—What are the advantages of the "Jäger" or the "Standard" grid over the ordinary type? What is the average quantity of sulphuretted hydrogen in the gas entering the purifiers?

4.—Describe a method of condensing gas which has for its main object the removal of H_2S and naphthalene, besides tar.

5.—Give the composition of common coal gas, blue gas, and carburetted water gas, including the volume of CO_2 usually passing the oxide purifiers, and the relative heating value per cubic foot of each.

6.—Give diagrams showing the method of working a gasholder guided and supported by means of ropes. What is the object of trussing the crown of a gasholder?

7.—Describe a method of determining the heating value of gas; giving examples of how the "gross" and "net" values are obtained. What is the relation between candle power and calorific power?

8.—Describe the manufacture of sulphate of ammonia. Give a sketch of a closed saturator, and name the quantity and strength of acid employed per ton of sulphate.

ORDINARY GRADE.

1.—What are the essential conditions for obtaining 11,000 cubic feet of 15-candle coal gas? Give sketch of the retort you would use.

2.—What is the "hydraulic" main as distinct from a "dry" main? Clearly set out the advantages of each.

3.—Give a description of one type of tubular condenser, and state what products are removed by it.

4.—Describe the working of a set of four purifiers filled with hydrated oxide of iron for the removal of SH_2, and state how you would test the gas at the outlet for its absence.

5.—What do you understand by the term "unaccounted-for gas," and what items does it embrace?

6.—Clearly set out the conditions which must be studied in order to satisfy consumers who use gas for light and heat.

7.—Describe, with the aid of sketches, the apparatus you would use to determine the percentage of sulphur in spent oxide.

8.—Describe the following burners, giving the duty obtainable per cubic foot when using coal gas: Slit-union; Regenerative; "C" incandescent; Bijou; and Kern.

The Mansfield Corporation and Water-Taps.—The Water Committee of the Mansfield Town Council were recently interviewed by a deputation from the National Association of Master Plumbers and the United Operatives' Society of Plumbers respecting the fixing by the Corporation of Kennedy's patent taps to properties supplied with outside taps. The Water Committee have now recommended the Council to inform the deputation that the work carried out in connection with the fixing of the taps was under exceptional circumstances; and that as the Corporation compelled owners to substitute such taps for those already in use, they considered it was only reasonable that the cost of fixing should be borne by the Corporation. The Committee, therefore, feel that they were perfectly justified in taking this course.

GENERATING STATIONS AND LONDON PARKS.

There has just been issued as a Parliamentary Paper a memorandum by the Commissioners of Works on the Electric Supply Bills now before Parliament, in which powers are sought for the supply of electrical energy in London, the granting of which, it is pointed out, will involve the development of generating works. The Commissioners say that, constituting as they do the public department in charge of the Royal parks and gardens, they have felt a growing apprehension as to possible injury from the products of combustion emitted by these extensive generating works to the life of the trees, plants, and flowers in the parks, and are not free from doubt whether the great national treasures in museums and picture galleries are not exposed to danger from this same cause. They think it right, therefore, in view of the introduction of all the legislative schemes referred to, to invite the attention of Parliament to the point, so that it may be fully taken account of in any inquiry upon them. The case is not entirely one of the emission or consumption of black smoke or sooty or tarry matters. The other products of combustion, such as sulphurous and sulphuric acid, with solid particles of mineral matter or ash, are very deleterious to vegetation, to buildings, and to pictures, marbles, metals, and other museum exhibits; and the ejection of volumes of oily steam from an adjoining generating station has occasioned much damage to shrubs and grass in Brompton Cemetery, which is under the charge of the Commissioners. Although the owners of generating stations are liable to the ordinary law against the negligent emission of smoke, the position is somewhat different as to the other products mentioned. The Commissioners point out that the Board of Trade, in Provisional Orders with regard to electric lighting in the provinces, incorporate the schedule to the Electric Lighting Clauses Act, 1899, section 81 of which runs as follows: "Nothing in the special Order shall exonerate the undertakers from any indictment, action, or other proceedings for nuisance in the event of any nuisance being caused or permitted by them." Although the Act of 1899 does not apply to London, such a clause has hitherto been generally inserted, it is believed, in London Orders. But it has not been introduced into Acts when specific sanction has been given by Parliament for the acquisition of particular sites for generating stations; and a practice has now begun to be adopted of giving statutory exemption from nuisance proceedings. The Commissioners consider that the cluster of generating stations growing up in the near neighbourhood of Regent's Park and other works may justifiably cause them peculiar uneasiness because of their situation. It would appear that smoke with its sooty and tarry particles can be so well consumed by proper apparatus that no danger ought to arise in this respect. Effectual means should be taken to secure that apparatus of the most approved character shall be employed for the consumption of smoke; and the use of dust-destructor refuse as fuel should be altogether prohibited. But the principal enemy to be combated, the Commissioners say, is sulphuric acid, the production of which can be much diminished, if not entirely prevented, by pouring lime water on to the coal before it goes into the furnaces; and they think that this condition, the fulfilment of which would involve small expense and not very much labour, might reasonably be insisted upon.

THE LIGHTING OF OXFORD STREET.

The Question of Gas or Electricity.

At the Meeting of the Marylebone Borough Council on Thursday, the question of the illuminant to be employed for the lighting of Oxford Street, on which a report had been presented by the Lighting Committee at the meeting of the Council on the 29th of March (see *ante*, p. 54), was under discussion. The Committee, it may be remembered, recommended that the tender of the Gaslight and Coke Company for lighting the thoroughfare named for five years should be accepted.

Mr. FORBES, in moving the adoption of the report, remarked that probably some of the members of the Council had been disappointed that the Committee did not advise the use of electricity. [A MEMBER: We deplore it.] He believed every gentleman present deplored it. At the outset, all the members of the Committee hoped that they would be able to see their way to recommend that Oxford Street should be lighted by electricity; but, after having fully considered the matter, and gone into every detail, they were reluctantly forced to decide against it for several reasons, and more particularly on account of its cost and ineffectiveness. The estimate of Mr. Wright, the Consulting Electrical Engineer, was that the installation of arc lamps would cost £3440, and that the annual expense for lighting and maintenance would be £1785. In addition to this, he was bound to mention that the Electricity Committee would have to expend an additional £3000 in laying special mains. It might be contended that this sum would come out of the funds of the electricity undertaking. Undoubtedly that was so; but the fact would remain that the total expense of the installation to the borough would not be £3440, but £6440. And this was only an estimate. A great difficulty the Committee had had to face was this—that while, on the one side, they had a clear and definite offer from the Gas Company, they could obtain nothing really definite from the Electricity Committee. All they could get was estimates. However, even on these the installation of gas would be very much cheaper, and the cost of maintenance would be £100 a year less. The next question was what they were going to get for their money. There was not much difference in the total illuminating power; the estimate of the Electricity Committee being 120,500 candles, and that of the Gas Company from 95,000 to 115,000 candles. It might be convenient here to mention that two other tenders had been sent in, for high-pressure gas. One was from the James Keith and Blackman Company, Limited, and the other from Messrs. Pontifex and Co. Both were so high that they were put aside; and so the tender of the Gaslight and Coke Company was the only one considered in detail against electricity. A point in favour of gas was the height of the lamps. The electric arc lamps would be 20 feet high; while the gas-lamps would be only 12 feet high. It was on the pavement that the light was mainly required, not on the first-floor windows, which the arc lamps would no doubt very successfully illuminate. Another point in favour of gas was that while there would be 163 gas-lamps and only 81 arc lamps, the latter would be 62 or 63 yards apart. The gas-lamps, being double in number, would distribute the light better than the arc lamps, and not leave dark patches between them. In the estimate for electricity it was proposed to make the lighting more economical, to extinguish half the lamps at 12.30. This would leave a space of 124 or 126 yards between each light. He did not believe the Council would ever consent to such a paltry piece of economy for an important thoroughfare like Oxford Street. Such a matter scarcely wanted argument. Altogether, Mr. Wright failed to make out a case before the Committee, though every member honestly desired to give the preference to electricity. They were, however, forced to the conclusion that they would have a better light at a cheaper price by accepting the Gas Company's tender. In the minds of many of the Councillors the question would doubtless arise: "What will people say of us if we, after having purchased the electricity undertaking for an enormous sum of money, now take gas for the lighting of Oxford Street—our most important thoroughfare?" Personally, if he thought the acceptance of the tender would injure the electricity undertaking, he would not support it. But what were the facts? The Electric Supply Committee would have to pay £3000 for special mains; and when this was taken out of the 1½d. per unit at which they offered to supply current, the margin for profit, after allowing for renewals and everything else, would be very small under the best circumstances. He believed that instead of a profit there would be a loss. It would be very different indeed if the figures given were to be absolutely adhered to, and if it could be shown on them that there would be a profit to the undertaking. It was said that it would be a good advertisement to have the arc lamps in Oxford Street. But it was not, he contended, the duty of the Lighting Committee to advertise the electricity undertaking; that should be done in the ordinary way out of its own funds. All over the country there was a decided movement in favour of gas instead of electricity for outdoor lighting. In the new Victoria Terminus and in the Broad Street Railway Station gas had superseded electricity; for though the latter had been offered at 1¼d. per unit, gas had been preferred as being more economical and more efficient. In the City of Westminster, the same thing was being done as electric light contracts fell in. Parliament Street, Whitehall, and the space all round the Houses of Parliament were now all lighted with incandescent gas. In Liverpool, where the Corporation owned the electricity undertaking, they were so convinced of the superiority of gas for street lighting that they had adopted it. There were many other instances which time would not permit him to cite; but he was convinced that if it was a question here of an electricity company competing against a gas company, not one member would support electricity in view of the overwhelming case which could be made out for gas for outdoor lighting. The Gas Company proposed to instal the Scott-Snell system, as adopted by the London County Council for the lighting of the new Vauxhall Bridge.

Mr. DEBENHAM, the Chairman of the Electric Supply Committee, in opposing the motion, said he was not prepared to go into details and would base his argument chiefly upon general matters. On first looking through the report of the Lighting Committee, he was amazed. If he had not seen Mr. Fowler's name at the end of it, he should have imagined that it had been revised by the Gas Company. Justice was scarcely done to electricity. For instance, it was asserted that electricity would cost £2198; whereas it had been definitely stated to the Committee that a loan could be raised, and the interest and sinking fund instalments paid out of £2019.

Mr. FOWLER: We made inquiries, and found that you could not get a loan at the price stated.

Mr. DEBENHAM accepted the figures £2198 in view of the explanation. He went on to say that the illuminating power of electricity (120,500 candles) quoted by Mr. Fowler was only the minimum; whereas the minimum of the gas was 90,000, and the maximum 117,000 candles. The speaker went on to argue that, candle power for candle power, electricity was the cheaper light by £350 a year. There could be no doubt, he said, if the Gas Company secured the contract they would widely advertise the fact, as had been done in the case of the City of London lighting; and in this way the position of the electricity undertaking of the borough would be injured. The whole situation as regards street lighting had been changed by the adoption of new arc lamps. He had no doubt that there would be a small profit to the undertaking on the price quoted, and this profit would go towards the cost of the award.

Mr. HOBAN, speaking against the adoption of the report, mentioned that the voting in Committee was 4 to 4, and the adoption of the report was only carried by the casting vote of the Chairman. He said a more suicidal proposition had never been brought before an intelligent body of men. The four gentlemen who supported the report in Committee had been great travellers. They had gone from St. Petersburg to Naples; and, according to them, in every place the electric lights were like farthing dips, while gas was so brilliant that it even made the sun look dim. (Laughter.) He submitted that to pass the recommendation would be disloyal to the borough.

Mr. SANDS said he hoped the Council would deal with this matter as business men. Their duty as ratepayers was to make the best bargain they could. It was worthy of note that the Chairman of the Electric Supply Committee had not made any attempt to dispute the fact that the installation of electricity would cost from £3000 to £4000 more than gas. A point which had not been considered was that the electric light standards might seriously interfere with some of the cellars; and in this way the cost of the installation would be much greater than that estimated. He was disappointed at not hearing more from the Electric Supply Committee as to the possibility of a profit being made; and on the whole of the facts he thought the Council ought to adopt the report.

Mr. WHITE said it should not be forgotten that the shopkeepers of Oxford Street had lately been adversely affected by street works. If the roadway was to be again opened to put down the electric mains, it

would be a calamity to these tradesmen. If the Gas Company's tender was accepted any serious disturbance of business would be avoided. This was a grave consideration in approaching the question. As to the idea of extinguishing half the lamps after half-past twelve, and leaving a space of 120 yards between the lights, all he could say was that if this were done there would soon be a revival in Oxford Street of the footpads of a hundred years ago. On paper the candle power of electricity might appear more than that of gas; but in practice the gas-lamps, with the light more evenly distributed, would be the better. This question would never have arisen if the electric undertaking had been owned by a private company. Some years ago, the Metropolitan Electric Light Company had offered current at 1¼d. per unit; and the Council had rejected the proposal, in favour of gas. In mentioning the places where gas had superseded electricity, Mr. Fowler had omitted the most important body who had adopted that policy—he referred to the London County Council. No one could say that the Council were friends of any company, gas or otherwise; but they had installed gas in Aldwych and Kingsway as being the cheaper and better light, and had done the same thing as regards the new Vauxhall Bridge. They could not in Marylebone do better than follow the example of the London County Council, and accept the tender of the Gas Company in the interests alike of good lighting and of economy.

At this point the discussion was adjourned for a fortnight.

GAS LEGISLATION IN NEW YORK.

An 80 Cent Gas Bill Passed.

It may be remembered that about a year ago, as the result of a long inquiry, a Commission of Gas and Electricity was appointed for New York. After preliminaries had been settled, the Commission held a few small inquiries, and towards the end of the year entered upon an investigation which engaged them for many weeks. It was in regard to two petitions which had been presented to them—one asking for the price of gas to be fixed at 75 c. per 1000 cubic feet, and the other for a "reduction warranted by the evidence." The inquiry lasted well into the present year; but before it could be completed, a Bill was introduced in the Senate by Mr. Stevens, who presided at the inquiry referred to in the opening lines, providing for a supply of gas at 80 c. Not satisfied with this, he followed it up with another which provided for legislating the Commission out of the office. We learn from "Progressive Age" that the first-named Bill was passed by the New York State Legislature by an overwhelming majority, and in due course was sent to the Mayor (Mr. G. B. M'Clellan) for his signature; and he had the customary public hearing at which representatives of the Consolidated Gas Company and the citizens were present. Mr. C. F. Matthewson, who appeared for the Consolidated Gas Company, said the provisions of the Bill would be so ruinous to the interests of his clients that they desired to oppose it at every turn. It would amount to a practical confiscation of part of the property of the Company, and would reduce them to a position in which they could earn only about 2 per cent. on their investment. He said further that 80 c. gas in New York City was almost less than the cost of production; and this meant that such a law would cut into their investment to an extent so great that bankruptcy would be imminent. The Mayor asked Mr. Matthewson if he really meant that the Company would go into bankruptcy if the Bill became law. He answered that he did not mean to give this impression; but he wished it to be understood that the price fixed by the Bill was ridiculously low and "only one degree removed from injustice." Mr. Dykman, who appeared for the Brooklyn Union Gas Company, said the price of 80 c. would confiscate their dividend-earning capacity. He was asked by the Mayor if the Bill would drive his clients into bankruptcy; and he admitted that the Company would continue to pay interest on their bonds. He said people must have gas, and the Company must produce it. He raised various points against the Bill, and contended that the fixing of the price of gas should be entrusted to the State Gas and Electric Commission. Other persons appeared against the 80 c. rate, principally bankers and stockholders. On the 20th of March, the Mayor signed the Bill, accompanying it by a statement in the course of which he said:

> Those who supply illuminating gas are public utility corporations. They are entitled, therefore, to a reasonable profit on the cost of production and distribution of the commodity they sell. If the legislative rate is sufficient to produce such a profit, they have no right to complain. It is clearly within the power of the Legislature, in such cases, to fix a rate in excess of which the Company may not charge the public, provided that it be not unjust to the Company. The rate heretofore fixed has long been unfair to the public. Both producer and consumer, under such circumstances, are entitled to justice as exact as human wisdom can apportion it; and any marked inequality to either would not be upheld by the Courts. The city, at the present time, has this exact question awaiting adjudication in its contest of all the claims of the Gas Companies for the past three years. The outcome of that litigation, it is expected, will silence every question on this point. If this measure was confiscatory of the property of the Gas Company, I would withhold my approval of it under all circumstances. But it is not confiscatory; and the unsupported statements of the Company's representatives to this effect are overthrown by the report of the Legislative Committee which last year examined the subject, as well as by the investigation of the expert engineers who have been engaged in the city's behalf in the litigation referred to.

The Governor of New York (Mr. Higgins) has also signed the Bill, so that it has now become law, and in future the Gas Companies will not be able, except in a few outlying districts, to charge more than 80 c. per 1000 cubic feet for gas. In a memorandum, the Governor said:

> The corporate interest affected by this legislation contend that inasmuch as the Legislature of 1905 created a Gas Commission with power to regulate the price of gas after investigation, it is inconsistent now to fix such price by law. A brief reference to the history of gas legislation refutes this plea. The Joint Committee of the Senate and Assembly was appointed to investigate the lighting question only so far as it concerned the city of New York. After taking much testimony on the cost of production, the value of plant, and the possible income of the Gas Companies, the Committee reported a number of Bills, including an 80 c. Gas Bill for New York City, and also a State Gas Commission Bill—the latter for the purpose of dealing with the question generally with special reference to other municipalities where no legislative investigation had been had to guide the action of the Legislature. Its findings sustain this Bill, and justify the conclusion that present rates are excessive.
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> Had all its Bills become law, no action by the Gas Commission would have been necessary for New York City; and no such action was originally contemplated. The Legislature is now but carrying into effect the original recommendations of its Committee. The 80 c. Gas Bill having been defeated last winter, it became necessary to resort to the Commission in order to obtain the desired relief which the Committee sought to give forthwith. But the Consolidated Gas Company not only questions the constitutional power of the Legislature to delegate to a Commission the authority to regulate the rates, but challenges in the Courts the fairness of the 80 c. rate already established by the State Commission for the borough of Manhattan. It is, therefore, entirely consistent and proper for the Legislature to deal with the matter directly and as effectively as possible, rather than abandon the original scheme of legislation recommended by the Committee.
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> Distrust of democratic institutions prevails where the self-interest of the few is potent and the self-interest of the many is powerless; where wealth rather than manhood determines who shall enjoy the choicest privileges in the community; and where public service corporations flourish while consumers suffer. Distrust of democracy likewise prevails where wealth is constantly threatened with confiscation by unjust and unequal laws. The hope of democracy lies not wholly in municipal ownership, where, the fair incentive of personal gain being withdrawn, public utilities may perhaps be operated in a shiftless manner and at a loss, so that taxation to property must be resorted to in order that such utilities may be enjoyed at less than cost. It lies rather in the careful restriction of companies to a fair return on the value of their investment.
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> When one devotes his property to a public use, he grants the public an interest in that use, and must submit to be controlled by the public for the common good. The State has the power to make reasonable regulation of the charges for services rendered by corporations engaged in the business of manufacturing and selling illuminating gas. To what extent may this regulation go? The authorities must fix upon a price which is reasonable. The power to regulate is not a power to destroy. The property of a corporation cannot be wrested from it for the benefit of the public. Its stockholders should receive some compensation for the use of the money they have invested. Yet the Courts have held that judicial interference should not occur unless the case presents, clearly and beyond all doubt, such a flagrant attack upon the rights of property under the guise of regulation as to compel the Court to say that the rates prescribed will necessarily have the effect of denying just compensation for private property taken for the public use. All laws regulating rates are subject to judicial review. Judicial inquiry may best determine where regulation ends and confiscation begins. But the power and duty of the Legislature in this case seem clear; and their example of prompt and vigorous action should be restraint on extortion and greed, and welcome evidence of the loyalty of public servants to the interests of the people.

IPSWICH AND THE SULPHUR RESTRICTIONS BILL.

At a Special Meeting of the Ipswich Town Council last Wednesday, the Paving and Lighting Committee reported that, in accordance with the views previously expressed by the Council, they had conferred with a deputation from the Directors of the Gas Company, who, however, did not see their way to withdraw from the Bill which they, in common with several other companies, are promoting in Parliament for the removal of the sulphur restrictions. But in a letter sent through the Town Clerk, the Secretary (Mr. J. T. Jolliffe) gave the Committee the Directors' assurance that "if, and when, the sulphur restrictions are removed, the Company will do their very best at all times to keep these sulphur compounds within reasonable limits by means of the ordinary methods of purification." He added that the Board think that, "with greater freedom of action, they will not only be able to keep these compounds down, but also to prevent the occasional excesses which prove so annoying to the consumers." The Committee said they still thought it was in the public interest that the sulphur clauses should be retained; but as the Departmental Committee of the Board of Trade did not share this view, there was little or no prospect of opposition to the present Bill being successful. Under these circumstances nearly all the towns and districts affected had ceased to oppose the Bill.

Mr. Raffe, who moved the reception of the report, remarked that personally he was of opinion that they ought to go on and fight the Bill—remembering as he did the sulphur in the gas prior to the clauses being inserted. Alderman Packard said he hoped before it was decided to withdraw opposition to the passing of a Bill which would do away with the public having the right to test the gas and compelling the Company to reduce the percentage of sulphur in it, the Council would see that the tests by the Gas Inspector were continued. If they had no parliamentary powers to insist upon improvement, they might get public opinion to bear upon the Company. Mr. Raffe replied that they had already decided to do this if the Council determined not to go on with the opposition. Mr. Ridley said he took the recommendation to mean that the Committee did not consider their opposition would be strong enough. He was sorry it was found necessary to withdraw the petition; but they could not help feeling that they would be running into an expenditure which would certainly be nearly useless in the end. Mr. Gibb remarked that if there was any hope of being successful, he would be the first to uphold the Council going on with their opposition. But influence and power were so numerous against them that it was impossible for them to do any good. Mr. Staddon was of opinion that, if it cost the town a considerable amount, it was best to make every effort to get the proposals withdrawn. The only advantage of withdrawing from the opposition might be to give a fillip to the electric light undertaking.

The report was then adopted—five voting against it.

The Nantwich Urban District Council have decided to ask the sanction of the Local Government Board to the borrowing of £3500 for mains, services, and prepayment fittings, for the extension of the gas supply to Willaston. The gas-works are capable of turning out the extra quantity of gas that will be required; so that the only expense involved will be the carrying of the mains to the township.

PRIMITIVA GAS COMPANY OF BUENOS AYRES, LIMITED.

An Increased Dividend.—The Advantages of Coalition.

The Annual General Meeting of this Company was held last Wednesday, at the London Offices, No. 153, Leadenhall Street, E.C.—Mr. H. E. JONES in the chair.

The SECRETARY (Mr. J. H. Bouwer) read the notice convening the meeting and the Auditor's certificate; and the report and accounts —some particulars from which were given in the "JOURNAL" for the 17th ult., p. 188—were taken as read.

The CHAIRMAN said he had now the pleasant duty of moving that the report and accounts be adopted; and this would carry the payment of the dividend recommended. It was always a pleasant task to address the shareholders of the Company; but it was even more pleasant than usual on the present occasion, because the Board were in a position to recommend an increased dividend of 7 per cent. on the ordinary shares. This was very gratifying to the Directors; but at the same time he would remind them that, when they averaged the distribution on the ordinary shares with the preferential dividend and the interest on the money raised by debenture, it left a return of barely 5 per cent. on the whole capital invested, which he thought gas shareholders would allow was not an exaggerated amount. It would now be the great ambition of the Board to bring about a diminution in the price of gas at Buenos Ayres, rather than increases in dividend, so as to make the gas still more available than at present for what he might say were the rougher trade and power uses, as compared with the select lighting use—from which developments most gas companies in Europe now derived not only great profits but very great stability. That this would be possible he was satisfied personally; and his colleagues shared the opinion. It would, however, be rendered still more possible if only in Buenos Ayres the three Gas Companies saw so much eye to eye that they were practically united. When he reminded the shareholders that in London something like 3½ million tons of coal were carbonized per annum by three Companies, while in Buenos Ayres about 140,000 tons, or twenty-five times less, were dealt with by the three Companies, he thought they would realize without much further remark from him how great would be the economies resulting from coalition. Certainly, steps in this direction would never fail in finding support from the Board of the Company. As to the accounts, he had to point out that the credit of the profit and loss account was this year £122,520, as against £115,458 last year. The balance brought forward as nearly as possible corresponded with that of twelve months ago—differing only by about £150. The amount of interest paid on debentures was slightly less, because of the sum that had been redeemed. Expenses of London Office, income-tax, &c., amounted to £8325, or something like £600 less than last year. The dividend on the preference stock was, of course, the same; and they were able to transfer to reserve against discount on debentures and expenses of issue £22,285, as against £4000 annual charge and £15,000 to reserve account for the previous year —altogether £19,000. This left a balance to credit of profit and loss account of £45,000 in round figures, as against £40,469 for the preceding twelve months. Thus the shareholders would see that the recommendation of the Directors in the matter of dividend could be amply justified. Now he had to turn to a part of the report which was perhaps the most sound financially and the most gratifying of the whole. The proprietors would remember that attention was called by one of the shareholders in the early days of the Company's meetings in London to the existence of the fund arising out of "Discounts on debentures, and expenses of issue," which was an item that then stood at a considerable figure. The amount had, however, been diminished annually, until for the present year it stood at £54,093; and inasmuch as in the course of the year certain lands which were not required by the Company were available for sale, and actually sold, and after repaying the sum to the capital account at which they then stood in it they had furnished an absolute margin of surplus profit of £20,611, and as there were certain other receipts of various sorts amounting to a sum of £1892, and inasmuch as they had already (as would be seen by last year's accounts) a sum of £9304 which had been carried to the reserve fund for specially dealing with this amount, the Directors thought they could not do better than take this profit and these balances, and also devote something like £22,000 out of the present accounts (which would be a very handsome contribution to any reserve fund), to the purpose of wiping off this obligation. If the amount had been reduced at the rate of £4000 or £5000 per annum, it would have been a burden for some years; whereas what they now proposed to do was to wipe it off at one stroke, and so remove this item from the balance-sheet. He thought perhaps this was one of the soundest acts of finance the Company had ever executed; and he was very pleased when meeting their distinguished Auditor—there was no one more distinguished as an auditor in the City of London than Mr. Touch—to hear that he fully endorsed this view, and congratulated the Directors on being able to accomplish what they had done. This brought him to the end of the report; and he would only add that the Secretary had furnished him with a complete analysis of the working in the period under review. He would only give them a few items from this; but the figures would enable him to answer any questions that might occur to the shareholders with regard to the progress and position of the undertaking. During 1905, they sold 9,884,186 cubic metres of gas, as against 9,457,720 cubic metres in the preceding year—being an increase of rather less than 5 per cent. They were able to sell as much as 10,345 cubic feet of gas per ton of coal carbonized, as against 10,036 cubic feet in 1904. Last year's figure was creditable; this year's figure was notable, and showed the efficiency of the staff at the works. The leakage (which was always a trouble with him) was slightly less—about ¼ per cent. less, at 13 per cent. The reason it was so high was that, owing to there being three Companies supplying gas, the pipes ran in many cases parallel with each other, and the consumption was divided, so that the output of gas per mile of main in Buenos Ayres was very poor indeed compared with places where there was a single company operating. This was only one of the economies which coalition would enable them to accomplish. The Company's operations showed that there had been a material advance in the trading prosperity of that part of the Argentine. During the period under review, 7078 metres of mains (equal to 4½ miles) had been laid; while 1083 metres had been relaid. The Board had now before them a proposal to lay a very large extent of main, the cost of which was estimated at £30,000; so that the shareholders would see the undertaking was not standing still, and was not likely to stand still. The number of new services laid was 1090; and nearly an equal number of additional meters had been fixed. They had also been placing a large number of those cooking and heating appliances which were popular in England, and which were now being so rapidly adopted in the Argentine. They were told when the Company was first formed that the customs and habits of the people would be against such things. He, however, had heard that story before; and he had generally made the same answer—that is, "Try." And on a trial, the Company had found them to "go." He concluded by moving the adoption of the report and accounts.

Mr. JOSEPH KINCAID formally seconded the resolution.

Mr. SPEAK said he would like the Chairman to tell them where the land was situated that had been sold, so as to give some idea to people who knew Buenos Ayres and the gas-works as to the sort of property it was, and why it had been disposed of.

The CHAIRMAN replied that it was surplus land. He was very gratified, on joining the Board, to find the local Directors had been so wise as to provide additional land and premises everywhere. The land in question was in the north of the city, near the chemical works; and they found they had no need to add it to the chemical works. It was bought when land was much cheaper than it was to-day. There was some more surplus land remaining to be dealt with the same way.

Mr. SPEAK remarked that there was another question with regard to which he would like some information. There had been rumours on the Stock Exchange and in the City that negotiations were taking place between them and the Railway Companies with a view to purchasing the land on which the gas-works stood.

The CHAIRMAN said he must ask the proprietor to forgive him if he did not say very much on this point. When negotiations and that sort of thing were at all in the air, the Directors must ask the shareholders to place a good deal of confidence in them, and not embarrass them. He could only say that the Board would be quite prepared to safeguard the interests of the Company, and to sell to the Railway Companies, if required, on proper terms.

The resolution was then carried unanimously.

Thereafter the retiring Director (Mr. Kincaid) was re-elected, on the motion of the CHAIRMAN, seconded by Mr. W. W. PHIPPS; and the Auditors (Messrs. George A. Touch and Co.) were re-appointed on the proposition of Mr. SPEAK, seconded by Mr. RYDER.

Mr. SPEAK proposed a vote of thanks to the Chairman, Directors, Secretary, and staff here and on the other side. He remarked that everyone had done well for the Company. They had had a splendid improvement this year; and everything pointed to further progress.

Mr. TYRE seconded the proposition.

The CHAIRMAN, in acknowledging the compliment, said it was always satisfactory to receive the recognition to which the shareholders had now treated them. It was a graceful winding up of the meeting. He had omitted in his speech to call attention, as he had intended to do, to a very able paper which was read recently before the Society of Arts by Mr. A. J. Martin, as to the enormous value of ordinary coal gas for the transmission of power, for the conservation of the coal measures, and for the development of trading purposes generally. It was accompanied by diagrams showing the shocking waste arising from the use of ordinary coal-fires; and it also gave striking illustrations of the enormous waste of steam-engines—especially small ones—as compared with gas-engines. The author further drew attention to the advantages of coal gas over producer gas. Sheffield were already selling gas for power at 1s. 1d. per 1000 cubic feet; while it was sold in London by two of the Companies at from 1s. 9d. to 1s. 10d. On the other hand, the price of gas in Buenos Ayres was about 8s. This would give the shareholders some idea of what was before them, if they could succeed in lowering the charge for gas in their area.

SOUTH BARRACAS (BUENOS AYRES) GAS COMPANY.

The report of the Directors of this Company for the twelve months ending Dec. 31 last, which was presented at the recent annual general meeting, stated that during the year the Company had, in effect, been reconstructed under the provisions of the South Barracas (Buenos Ayres) Gas and Coke Company, Limited, Act, 1905. The debentures and all the debts owing by the Company (except current trading accounts) had been paid; and the share capital and property account now stand as shown in the accounts accompanying the report. The profits for the year amounted to £6161; and after deducting interest on debentures (£1338), there remained a balance of £4823, out of which the Directors recommended a dividend at the rate of 5 per cent. per annum, free of income-tax, carrying forward £2223. In moving the adoption of the report, the Chairman (Mr. F. C. im Thurn) remarked that the year covered by it was the first in which the Company had stood alone, as previously the property was leased to the Buenos Ayres (New) Gas Company, Limited. So long as this was the case, they drew the whole of the necessary working capital from that Company. But the time had now come when they must provide capital of their own, to enable them to take full advantage of the powers conferred by their Act, as they supplied gas to a very extended area, including several favourite suburbs of Buenos Ayres. It was therefore the intention of the Directors to make a further issue of shares. The districts served with gas by the Company had been severely handicapped by the absence of water supply other than that obtained from private wells. A concession for the supply of water recently passed through most of the formal stages necessary to the consent of the Federal Government of Argentina, and

would, it was believed, shortly become law. This concession the Company were empowered to acquire; and it could be managed to the advantage of these districts and the benefit of the shareholders. The consumption of gas continued to increase in a very gratifying manner; and the Company were at present at work on their first contract for public lamps. Those already erected gave great satisfaction. He concluded by congratulating the proprietors on the prospects of the Company. The report was unanimously adopted, and the dividend recommended was declared.

BLACKPOOL'S BIG PROFIT.

Mr. John Chew, who has never yet failed to show a surplus as the result of the operations of the Blackpool Gas-Works, of which he has for many years been Manager, was able last week to submit to his Committee a very gratifying statement of the past year's working.

The total output for the twelve months eclipsed all records, amounting to 495 million cubic feet—an increase of 18½ million cubic feet on the previous year, and by far the largest advance reported since 1901, when a succession of comparatively lean years commenced. No fewer than 305 additional consumers were added during the year; bringing the total up to 12,765, of whom about 2700 use slot meters. Though there was a greater sale of residuals, the income from this source was below that of the previous year, owing to falling markets; the receipts from coke and tar alone being £1300 less. But in spite of this, there was a gross profit on the working of about £28,000, or equivalent to a return of 13½ per cent. upon a capital of £210,000. After the usual deductions have been made for loan charges and sinking fund, there will still remain a disposable profit of over £17,000, or about the same as for the preceding year, when £15,761 was devoted to the rates and £2093 to the renewal fund. Some forty years ago the price charged for gas in Blackpool was 5s. 10d. per 1000 cubic feet; but this figure Mr. Chew has gradually reduced, until it is now only 2s. 4d. Concurrently with the reducing of the price, the profits have risen by leaps and bounds, until for the last three years they have averaged close upon £18,000 per annum. The aggregate profit from the gas-works from 1867 to the present day has actually exceeded £360,000, of which some £138,000 has gone towards loan charges, while a renewal fund amounting to over £20,000 has been established, and the large sum of about £195,000 has been devoted to relieving the rates. Blackpool ought to be, and we may safely say is, grateful to Mr. Chew for his able management.

BRIGHTON GAS COMPANY AND DEPRECIATION.

In the course of his report on the annual accounts of the Brighton and Hove Gas Company which the Borough Accountant has lately presented to the Town Council, he calls attention to the fact that the only direct charge made for depreciation by what is an "admittedly well-managed Company" is in respect of a minor item—viz., "fittings and stoves let on hire," the value of which is annually written down, until completely extinguished, by an annual charge calculated at 17½ per cent. on the ascertained costs. He points out that, so far as mains, works, and plant generally are concerned, no charge is made for their depreciation; but he acknowledges that "the cost of all renewals and replacements is debited to the revenue account." He then goes on to say: "It is generally held that the expense necessarily incurred from year to year of maintaining a well-established gas-works in a state of working efficiency is approximately equivalent to the actual average annual deterioration occasioned to the works and plant by reason of wear and tear. It by no means follows, however, that there are always capital assets in existence representing in value the total capital outlay. It is obvious that even in the case of a gas undertaking in connection with which abandoned works or disused mains are unknown, were an expert valuation to be made, it must reveal serious discrepancies between the actual values and the book values of the fixed assets, unless such book values had been specially written down. Undoubtedly the discrepancies would be far greater in the case of any undertaking burdened to any considerable extent with 'derelict assets,' for seldom do gas or other similar companies restore out of revenue capital expended on works and plant that have fallen out of use and have not been replaced. It is certain that if the Brighton and Hove Gas Company were placed under an obligation to write off the difference between the present-day value of their capital assets and the total capital expenditure to date, they would be called upon to face a very heavy liability."

CREDITON GAS COMPANY'S BILL.

Provisional Agreement with the Opponents.

A Meeting was held at Crediton last Tuesday for the purpose of considering the action of the Urban District Council in reference to the Bill promoted by the Crediton Gas Company to enable them to supply electrical energy. Sir Redvers Buller, the Chairman of the Council, presided, and explained that the gas-works, which had been carried on for many years by a private Company, had been purchased by a London Syndicate, who were now applying for parliamentary powers. The promoters also sought by their Bill to obtain authority to establish electric lighting works, so that practically they would have the sole right to supply gas and electricity. The District Council had a meeting with the promoters of the Bill; but they did not arrive at a satisfactory arrangement, and decided to oppose the Bill. Under the old Company, the capital was about £3000; but during recent years this had been increased because the plant had to be renewed at a cost of some £3000. The Syndicate had paid £7250. In the Bill, the capital was taken at £10,000; and permission was sought to raise it to £27,000. No doubt the promoters would say this was merely a precautionary measure, in case the population of Crediton greatly increased. The Council, however, thought that if the Company had power to raise so much money there ought to be some agreement which would prevent the increase of the charge for gas. The great thing to secure was that they would only have to pay a fair price for it; and they hoped to obtain this by getting the capital cut down, and also by preventing the Company obtaining power to supply electricity.

On behalf of the promoters, Mr. Schultz said that when the present Company acquired the undertaking it was not their intention to supply electricity; but they were informed that if they obtained authority to do so there would be a ready response on the part of the inhabitants. If it was not desired, the Company would withdraw the application for electric lighting powers. He would suggest the insertion in the Bill of a clause to the effect that the Company could apply for a Provisional Order in the future. If they had not to supply electricity, the capital could be reduced from £27,000 to £17,000. The Chairman asked if the insertion of the suggested permissive clause would debar any other body from making an application for electric lighting powers. Mr. Schultz said it would not. Mr. J. Mortimer said the concern would be over-capitalized if the amount was allowed to remain at £27,000; and it was madness to suppose the Company would pay, in a town like Crediton, on such an enormous capital. The standard price of 5s. per 1000 cubic feet was also too high. Mr. Schultz said he was prepared to reduce it to 4s. 6d., and would guarantee that it should never exceed this figure so long as the price of coal remained as at present. The Company proposed to lay before the District Council a scheme for lighting the public lamps every night, and not, as at present, on certain nights only. The capital was increased from the original amount because the Company thought of laying mains to Sandford, and also of providing gas-stoves. It was not intended to raise more capital than was required.

After some further discussion, Mr. Schultz agreed to the following terms: That the capital of the Company shall not exceed £5300 in ordinary shares entitled to a dividend of 10 per cent; £4000 in preference shares at 5 per cent.; and £7700 additional shares at 7 per cent.; that the Company shall not pay a larger dividend than 5 per cent. until the price of gas is reduced below 4s. 6d. per 1000 cubic feet; and that the price of gas shall not exceed the figure named so long as coal is not above 20s. per ton. It was also agreed that the electric lighting part of the Bill should be struck out, and that the charge for public lighting should not be raised pending the execution of a fresh agreement. These conditions are to be submitted to Counsel, and, if approved by him, they will be confirmed by the District Council, and the opposition to the Bill withdrawn.

COLOGNE MUNICIPAL GAS SUPPLY.

A recent number of the "Journal des Usines à Gaz" contained some statistics in regard to the gas supply of Cologne, taken from the report presented to the Municipal Council on the working of the gas undertaking for the year ending March 31, 1905.

The total production of coal gas was 39,493,490 cubic metres, and of carburetted water gas 423,170 cubic metres; making a total of 39,916,660 cubic metres, or about 1409 million cubic feet. The total output was 39,936,060 cubic metres, or 4·58 per cent. more than in the preceding year. The consumption was 37,336,710 cubic metres, or close upon 1318 million cubic feet; being 3·49 per cent. greater than in the year 1903-4, and representing 93·49 per cent. of the entire output. The unaccounted-for gas increased by 24·37 per cent., and represented 6·51 per cent. of the output. The total quantity of gas consumed was used as follows: For private lighting, 17,442,471 cubic metres; for public lighting, 5,700,596 cubic metres; for heating, cooking, and motive power, 13,751,271 cubic metres; for the works and offices, 442,372 cubic metres. The consumption per inhabitant was 96·73 cubic metres, or 3415 cubic feet, compared with 95 66 cubic metres, or 3380 cubic feet, in the preceding year.

The quantity of coal of various kinds carbonized amounted to 124,941¼ metric tons, and the average yield of gas was 11,115 cubic feet per ton; the charge weighing 4·35 cwt. The maximum make of gas per 24 hours was 181,910 cubic metres, or about 6,423,500 cubic feet. At the end of January. 1904, there was brought into use plant for the production of about 1⅞ million cubic feet of water gas per day, but capable of being increased to twice this quantity. The plant consists of two generators and two superheaters on the Strache system, each equal to the production of 35,000 cubic feet of carburetted water gas per hour. The installation produced during the year covered by the report about 12¾ million cubic feet of gas carburetted with oil, and 2¼ million carburetted with benzol. Plans were prepared for new coal-gas works equal to the production of about 300 million cubic feet per annum, in three sections, each capable of turning out 2 million cubic feet of gas per day—the first two sections to be ready for service by the autumn of the present year.

The portion of the report dealing with residuals shows that 71,702 metric tons of coke were produced; representing 57·39 per cent. of the total weight of coal carbonized; and 60,885 tons of it were sold at an average price of 16 frs. 10 c. per ton. In this connection, there was given a table showing the average price realized per ton of coke since the year 1897-8. It was then sold for 14 frs. 95 c.; and the price went up to 20 frs. 5 c. in 1900-1. This was the highest figure reached; the minimum occurring in 1903-4, when the figure was 10 frs. 65 c. Of tar, 5,834,282 kilos. were made; being 4·67 per cent. of the weight of coal carbonized. It fetched, on an average, 32 frs. 50 c. per 1000 kilos. The make of sulphate of ammonia was 1,172,647 kilos., which was sold for 246 frs. 48 c. per 1000 kilos. The spent purifying material, of which 885,000 kilos. were produced, was disposed of at the rate of 25 frs. 77 c. per 1000 kilos. This material held 11·64 per cent. of ferrocyanide, containing 7·92 per cent. of prussian blue.

With regard to distribution, there were in use for the public lighting, at the close of the financial year, 10,768 lamps, of which 9040 were fitted with single and 1728 with double incandescent burners—a total of 12,496; 4 lanterns each containing one alcohol incandescent burner; 54 lanterns with ordinary batswing burners; and 223 petroleum lamps. In addition to the foregoing, there were in use two lamps

furnished with Denayrouze burners, and 345 supplied with high-pressure gas—254 of them having single, and the remainder double burners. At the same period, there were 23,966 consumers on the books; and 34,559 meters, representing 423,485 burners, in use—the number of meters having increased during the year by 529 of the dry, and 2610 of the wet class. There were at work 770 gas-engines, representing 3690-horse power; being an increase of 39 engines and 197-horse power on the figures for the preceding year. The revenue was £202,082, and the expenditure £91,036—showing a profit of £111,046. From this had, of course, to be deducted the interest and sinking fund, amounting to £29,239; so that the amount actually paid into the Municipal Exchequer was £81,807, compared with £71,396 in 1903-4—an increase of £10,411.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The financial year of the Dundee Corporation gas undertaking expires on Monday, April 30—that is, before the publication of this note. Already there is speculation in the city as to the position it will occupy when the accounts are made up; and the expectation has been formed that there may be a reduction in the price of gas to the amount of 1d. per 1000 cubic feet. Within recent months, it is said, there has been a large increase in the price of coal; but the contracts for coal for the Gas Department have been secured on most advantageous terms, with the result that all over it is likely that the increase in price will not be more than 3d. per ton above the price paid during the past year. Notwithstanding competition with the electric light, the Gas Department has continued to hold its own; the natural increases in the consumption having been—with the exception of 1904-5—maintained year by year. During the past year, there was an increase of 30 million cubic feet in the consumption, which represents a profit of fully £1500. Since the appointment of Mr. Alex. Yuill as Gas Manager, three years ago, there has been a gratifying reduction in the price of gas; for whereas the figure stood at 3s. 6d. per 1000 cubic feet when he was appointed, the present price is 2s. 8d. If the contemplated reduction takes effect, it will be 2s. 7d., which will be the lowest price at which gas has ever been supplied in Dundee.

The proposal has been made that the Corporation of Aberdeen be asked to introduce a supply of gas into the village of Dyce, which lies to the north of the city. In connection with the proposal, a meeting of the inhabitants was held on Wednesday evening, at which it transpired that the movement arose out of a suggestion by a Committee of the City Corporation that powers be obtained to extend the electric lighting of the city to Culter on the west and to Dyce on the north. A village Committee took the matter up, and, finding that the Corporation have already power to supply gas within the parish of Dyce, they wrote asking the Corporation on what terms they would agree to supply gas. Mr. S. Milne, the Gas Engineer at Aberdeen, explained to the meeting that he was not present officially, and that nothing which he might say was to be taken as compromising the Town Council. An application had been received from Dyce for a supply of gas, and asking upon what terms it would be given. The Gas Committee of the Corporation had remitted the matter to him for a report; and at the same time they indicated that the Dyce people should take a plebiscite to ascertain whether the demand was to be universal, and whether it would be worth their while coming to Dyce. He thought they would find the Town Council ready to favourably consider any representation they might make. It would cost a considerable sum of money to extend the gas-mains to Dyce. There was about a mile of the road upon which there would be no consumption of gas. It was a "far cry" from Aberdeen to Dyce; and if they wanted a supply of gas they must make a strong representation to the Town Council. The procedure proposed was that they should get the signatures of the tenants who favoured the proposal—guaranteeing that they would take a supply of gas provided the Town Council extended the mains, and that the price of the gas would be the same as that charged in the city. But the signatures of the tenants would not do alone; they must have the signatures of the proprietors that they would undertake to lay the service-pipes from the road to the buildings, and introduce gas-fittings into the houses. On the grounds of economy, cleanliness, convenience, and comfort, there was no comparison at all between gas and paraffin oil. The proprietors would also have to pay the cost of laying the service-pipes from the road to the inlet of the meter, which, in the case of there being only one tenant in a house, would be about 39s.; and if there were two or more tenants, it would be about 10s. more. In reply to a question, Mr. Milne said that the charge for gas for public lighting would be the usual rate of 2s. 9d. per 1000 cubic feet, with a discount of 1d. after the consumption had reached 35,000 cubic feet. It was unanimously resolved that the local Council, along with several others, should canvass the district, to find out the number of people who were prepared to take in gas. Mr. Milne was thanked for his explanations.

The grand exhibition of gas appliances which is at present open in the Music Hall in Aberdeen has, it is reported, been a great success, both in the matter of attendance and in the amount of business done. On Wednesday last the Lighting Committee of the Corporation of Aberdeen paid an official visit to the exhibition, and on the same day the Directors of the Stonehaven Gas Company inspected it with much interest and pleasure.

With regard to the public lighting of Edinburgh, it may be stated that on Tuesday of this week the Cleaning and Lighting Committee resolved to recommend that, in the conversion of the flat-flame burner lamps into inverted incandescent lamps, one-fourth of them be fitted with burners consuming 2 cubic feet of gas per hour, and the remaining three-fourths with burners consuming 2½ cubic feet per hour.

The Corporation of Lockerbie have provisionally accepted the tender of Messrs. R. Dempster and Sons, Limited, of Elland, for the erection of the retort-bench in the reconstructed gas-works. The price is to be £719, with £16 extra if a travelling platform be adopted. This was the lowest offer. The Committee desired that other items be left in their hands, and the Council agreed; it being arranged that the full scheme will be laid before them at a special meeting.

The "Falkirk Herald" of to-day contains the announcement that at a meeting of the Gas-Works Committee of the Falkirk Town Council on Monday last the Committee unanimously agreed to grant Mr. M'Crae, the Gas Manager, a month's leave of absence, and voted him a sum of £50 towards the expenses of his holiday. Mr. M'Crae, I learn privately, has gone to Harrogate. At the same meeting, the Committee had under consideration the arrangements for the opening of the new gas-works, which has been fixed for Wednesday, the 9th of May. Provost Christie is to preside; and the opening ceremony is to be

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 284.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	21—22	..	4 15 5
160,000	10	,,	7½	Do. 7 p.c.	14½—15½	..	4 16 9
200,000	5	Nov. 15	7	Bombay, Ltd.. . . .	6¾—7¼	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	4¼—5¼	..	5 6 8
50,000	10	Mch. 9	14	Bourne-) 10 p.c. . .	28½—29½	..	4 14 11
51,810	10	,,	7	mouth Gas) B 7 p.c. .	16½—17½	..	4 0 0
53,200	10	,,	6	and Water) Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	Feb. 22	12½	Brentford Consolidated	263—268	..	4 13 3
300,000	,,	,,	9½	Do. New . . .	197—202	..	4 14 1
50,000	,,	,,	5	Do. 5 p.c. Pref. .	123—128	..	3 10 11
206,250	,,	Dec. 14	4	Do. 4 p.c. Deb. .	105—108	..	3 14 1
220,000	Stk.	Mch. 9	11¼	Brighton & Hove Orig.	230—235	..	4 15 9
246,320	,,	,,	8¼	Do. A. Ord. Stk. .	163—168	..	4 18 3
460,000	20	Apl. 11	10	British	42—43	−½	4 13 0
100,000	Stk.	Feb. 22	6	Bromley, Ord. 5 p.c. .	121—124	..	4 16 9
165,700	,,	,,	4½	Do. do. 3½ p.c. .	92—95	..	4 14 9
500,000	10	Oct. 13	7	Buenos Ayres (New) Ltd.	12¾—13	−¼	5 7 8
250,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. .	97—99	..	4 0 10
150,000	20	Mch. 9	8½	Cagliari, Ltd.	23—25	..	6 12 0
100,000	10	Sept. 28	10	Cape Town & Dis., Ltd.	16¾—17¼	−¼	5 15 11
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.. .	9¼—10¼*	..	4 7 10
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	53—55	..	5 9 1
50,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	100—102	..	4 8 3
1,443,280	Stk.	Feb. 22	5⅛	Commercial 4 p.c Stk. .	114—116	..	4 9 7
560,000	,,	,,	5	Do. 3½ p.c. do. .	111—113	..	4 8 6
475,000	,,	Dec. 14	3	Do. 3 p.c. Deb. Stk.	85—87	..	3 9 0
800,000	Stk.	,,	6¼	Continental Union, Ltd.	129—132	..	4 18 6
200,000	,,	,,	7	Do. 7 p.c Pref.	143—148	..	4 14 7
432,070	Stk.	Feb.	5½	Derby Con. Stk. . . .	122—124	..	4 8 9
55,000	,,	Jan.	4	Do. Deb. Stk. . . .	105—107	..	3 14 9
486,090	10	Jan. 25	11	European, Ltd. . . .	23—24	..	4 11 8
354,060	10	,,	11	Do. £7 10s. paid	17—18	..	4 11 8
15,223,235	Stk.	Feb. 8	4⅛	Gas-) 4 p.c. Ord. . .	93—97	−2½	4 10 10
2,600,000	,,	,,	3½	light) 3½ p.c. max. .	87—89	−1	3 18 8
3,799,735	,,	,,	4	and) 4 p.c. Con. Pref.	107—110	−1½	3 12 9
4,193,975	,,	Dec. 14	3	Coke) 3 p.c. Con. Deb.	87—89	−1	3 7 5
258,740	Stk.	Mch. 9	5	Hastings & St. L. 3½ p.c.	98—102	..	4 18 0
82,500	,,	,,	6½	Do. do. 5 p.c.	121—124	..	5 4 10
70,000	10	Apl. 11	11	Hongkong & China, Ltd.	19½—20½	..	5 7 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental .	235—237	−1	4 4 5
473,600	Stk.	Feb. 8	3½	Do. 3½ p.c. Deb. Red.	96—98	..	3 11 5
175,242	Stk.	Mch. 28	6	Lea Bridge Ord. 5 p.c. .	121—126	..	4 15 3
561,000	Stk.	Feb. 22	10	Liverpool United A . .	235—237	..	4 4 5
718,100	Stk.	Feb. 22	7	Liverpool United B .	169—171	..	4 1 10
306,083	,,	Dec. 29	4	L'rpool Unit'd Deb. Stk.	109—111	..	3 12 1
75,000	5	Dec. 14	5	Malta & Medn., Ltd. .	4¼—4⅜	..	5 5 3
560,000	100	Apl. 2	5	Met. of) 5 p.c. Deb..	101—103	..	4 17 1
250,000	100	,,	4½	Melbourne) 4½ p.c. Deb.	102—104	..	4 0 7
541,920	20	Nov. 15	3½	Monte Video, Ltd. . .	11¼—12½	..	5 12 0
1,675,892	Stk.	Feb. 22	4½	Newc'tle & G'tesh'd Con.	108—110	..	4 4 1
406,025	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	98—100	..	3 10 0
15,000	10	Mch. 9	10	North Middlesex 10 p.c.	19—20	..	5 0 0
52,940	1	,,	7	Do. 7 p.c.	1½—1¾	..	5 3 8
300,000	Stk.	Nov. 30	8	Oriental, Ltd. . . .	150—153	..	5 4 7
600,000	5	Mch. 28	7	Ottoman, Ltd. . .	6—6¼	..	5 7 8
398,490	5	Apl. 26	7	Primitiva Ord. . . .	6½—7*	..	5 0 0
796,980	5	Jan. 25	5	Do. 5 p.c. Pref. .	5¼—5½	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	98—100	..	4 0 0
851,070	10	Apl. 26	7	River Plate Ord. . . .	12¾—13¼*	..	5 5 8
300,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. .	98—100	..	4 0 0
250,000	10	Mch. 28	8	San Paulo, Ltd. . . .	14—14½	..	5 8 6
70,000	50	Jan. 2	5	Do. 5 p.c. Deb. .	50—52	..	4 16 2
135,000	Stk.	Mch. 28	10	Sheffield A	244—246	..	4 1 4
209,984	,,	,,	10	Do. B	243—245	..	4 1 8
523,498	,,	,,	10	Do. C	243—245	..	4 1 8
126,106	Stk.	Mch. 9	5½	Shrewsbury Ord. 5 p.c.	108—118	..	4 13 3
70,000	10	Sept. 28	10	South African	16½—17½	..	5 14 3
6,250,000	Stk.	Feb. 22	5½	South Met., 4 p.c. Ord.	125—127	−2	4 6 8
1,895,445	,,	Jan. 11	3	Do. 3 p.c. Deb.	87—89	−1	3 7 5
575,000	Stk.	Mch. 9	5½	S'th Suburb'n Ord. 5 p.c.	120—123	..	4 9 5
60,000	,,	,,	5	Do. 5 p.c. Pref. .	125—130	..	3 16 11
112,533	,,	Jan. 11	5	Do. 5 p.c. Deb. Stk.	132—137	..	3 13 0
502,310	Stk.	Nov. 15	5	Southampton Ord. . .	109—112	..	4 9 3
120,000	Stk.	Mch. 9	6¼	Tottenham) A 5 p.c. .	124—127	..	4 18 5
363,020	,,	,,	4¼	and) B 3½ p.c. .	99—102	..	4 13 2
137,500	,,	Dec. 14	4	Edmonton) 4 p.c. Deb.	105—107	..	3 14 9
182,380	10	Dec. 29	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
30,000	Stk.	Feb. 22	7½	Wands-) A 5 p.c. . .	—	..	—
255,636	,,	,,	6¼	worth) B 3½ p.c. . .	133—136	..	4 11 11
75,000	,,	,,	5⅛	and) C 3½ p.c. . .	110—113	..	4 16 0
69,416	,,	Dec. 29	3	Putney) 3 p.c. Deb. Stk.	82—85	..	3 10 7
745,872	,,	Mch. 9	5⅛	West Ham 5 p.c. Ord. .	107—109	..	4 14 0
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	122—125	..	4 0 0
193,300	,,	Dec. 29	4	Do. 4 p.c. Deb. Stk.	106—109	..	3 13 5

Prices marked * are "Ex. div."

performed by Mrs. Boyle, the wife of the Convener of the Committee. In a letter from Mr. M'Crae, he intimated that, on account of his illness, he would be unable to be present on the day of the opening, but that he had arranged that Councillor Neilson should perform any duties which should have fallen upon him. The Committee approved of the arrangement.

We all know that in the race for supremacy as between the safe-maker and the burglar, the burglar has, at the present time, the best of it. That is to say, there is no safe on the market which a burglar cannot break into, given reasonable facilities. This is sufficiently disquieting; but safe-breaking is an art which is confined within a limited area, and the general public has not been much affected by it. Now, however, the burglar has begun to turn his attention to the prepayment meter—a practice which, unless it can be stamped out, will touch a great many more individuals. If the practice be allowed to go on, it may turn out to be one of the greatest drawbacks to the use of the prepayment gas-meter. A young man named Woods, with an unenviable record of crime, was sent into penal servitude for five years by Lord Dundas in the High Court of Justiciary in Edinburgh yesterday, having admitted twenty charges of theft, mostly by housebreaking, in nearly half of which the theft was from the money-boxes of prepayment gas-meters. Only small sums were taken from the meters—a few shillings in each instance; but the amount stolen is not of the essence of the annoyance. It is the fact that, it being known to the thieving fraternity that prepayment gas-meters contain money, there is the likelihood of a run being made upon them. The annoyance is to the people whose houses are liable to be broken into; to the gas-supplying body, whose money is likely to be stolen; and to the makers of meters, whose trade is certain to be affected if the practice should spread. The question of how to check the growing evil of tampering with prepayment meters is one which is worthy of serious consideration. Perhaps some way of avoiding the present threatening situation may yet be devised.

The Uddingston Merchants' Association met on Wednesday evening to consider, among other matters, a reply received from the Bothwell and Uddingston Gas Company, to a communication sent to the Company complaining of the poor quality of the gas and the increase in cost, and asking what rate of interest was allowed upon money deposited as security, and when such money was returned. The reply was to the effect that the President of the Association, having been one of the deputation from the public meeting to the Directors, would communicate their reply upon the first two points to the Association; that the interest on security deposits had been at the rate of 5 per cent. since the passing of the Company's Act in 1902; and that deposits were only returned when consumers ceased to use the Company's gas.

The Elgin Town Council last week considered a proposal for the introduction of electric lighting into the town. Bailie Wilson said they had previously considered the possibility of getting electric lighting by means of power from the waters of the Lossie, but did not adopt it. When it was found to be necessary to expend £4000 upon a new gas-holder, the feeling of the Town Council was that if they required to expend this amount upon plant for the additional storage of gas, they ought to consider the question of the introduction of the electric light. The proposal was to use the refuse of the town in generating power. He had no intention of going in for street lighting, because he granted that the electric arc lamp was not a success. Incandescent gas-lamps were much better. Bailie Gordon, the Convener of the Gas Committee, said that if they had obsolete gas-works, he would have no objection to the introduction of electric lighting; but seeing that they had gas-works which were unequalled in the North of Scotland, and on which they had spent £3000 or £4000, he did not think they were justified in expending more money. He would rather see the £1600 proposed spent upon the improvement of the streets of the town than upon an illuminant which was not required. After discussion, it was found that the feeling was against the introduction of the electric light, and the subject was deferred for further consideration.

Last week I referred to the erection of the new town at Duntocher, by Messrs. R. M'Alpine and Son, of Glasgow. This week it is announced that application has been made for a Provisional Order conferring powers for the supply of water to Clydebank and the district—including Duntocher. There is at present a special water district for Duntocher and Dalmuir, which it is proposed to abolish and to incorporate in the Clydebank district. When this special district was formed, Clydebank was sparsely populated—containing not more than 500 persons. It has now a population of 25,000, and is one of the most important industrial and shipbuilding centres in Scotland. It is proposed that the first Trustees shall be the Town Council of Clydebank, and that afterwards the Trustees shall be limited to eighteen, of whom three will be elected by the County Council. The new works proposed include several reservoirs, with necessary auxiliaries.

New Joint Stock Companies.—The New Air-Gas Syndicate has been registered with a capital of £20,000, in £1 shares, to acquire from Mr. F. J. Cox certain existing inventions relating to air-gas machines or other gas apparatus. The Dove Bank Water Supply Company, Limited, has been formed with a capital of £2000, in £1 shares, for the purpose indicated by the title.

Gas Profits Relieve the Rates at Stalybridge.—The Stalybridge Gas Committee have resolved to transfer £2602 from revenue account to the credit of the borough rate. The gross profit on the undertaking for the past year was £6458, after allowing £900 extra depreciation for stock, meters, stoves, and fittings. This sum was reduced by interest amounting to £3583, and by sinking fund £1382; leaving a net profit of £1488, which was carried to the credit of profit and loss account. The balance brought forward last year on profit and loss account was £4053, and with the £1488 added it became £5523. It is stated that the past year was probably one of the most successful the Gas Committee have ever had; while the highest price charged to any consumer for gas was not more than 2s. 1d. The consumption increased by about 5 million cubic feet during the year.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
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CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
Blackburn	1,250,000	Buffalo, N.Y.	2,000,000	Newcastle-on-Tyne	1,800,000
Windsor St. Works, Birmingham	2,000,000	Winnipeg, Man.	500,000	Leeds	1,800,000
Saltley Works, Birmingham	2,000,000	Colchester (Second Contract)	300,000	Malton	150,000
Colchester	300,000	York	750,000	Smethwick	500,000
Birkenhead	2,250,000	Rochester	500,000	Gravesend	300,000
Swindon (New Swindon Gas Co.)	120,000	Kingston, Ont.	300,000	Pernambuco, Brazil	125,000
Saltley, Birmingham (Second Contract)	2,000,000	Crystal Palace District	2,000,000	Duluth, (Second Contract)	300,000
Windsor St., Birmingham (Second Contract)	2,000,000	Duluth, Minn.	300,000	Leicester (Second Contract)	1,000,000
Halifax	1,000,000	Caterham	150,000	Newport (Second Conttract)	250,000
Toronto	250,000	Leicester	2,000,000	Brockville	250,000
Ottawa	250,000	Enschede, Holland	150,000	Toronto (Third Contract)	750,000
Lindsay (Remodelled)	125,000	Buenos Ayres (River Plate Co.)	700,000	Montreal, Ont. (Second Con.)	1,800,000
Montreal	500,000	Burnley	1,500,000	Toronto (Fourth Contract)	1,000,000
Toronto (2nd Cont., Remodelled)	2,000,000	Kingston-on-Thames	1,750,000	Hamilton, Ont.	400,000
Belleville	250,000	Accrington	500,000	Rochester (Third Contract)	1,600,000
Ottawa (Second Contract)	250,000	Tonbridge	300,000	Leeds (Second Contract)	900,000
Brantford (Remodelled)	200,000	Stretford	500,000	Buenos Ayres (Primitiva Co.)	1,200,000
St. Catherines (Remodelled)	250,000	Oldbury	300,000	Buenos Ayres (New Co.)	1,200,000
Kingston, Pa.	125,000	Todmorden	500,000	Christchurch, N.Z.	300,000
Peterborough, Ont.	250,000	Saltley, Birmingham (Third Contract)	2,000,000	Rochdale	1,600,000
Wilkesbarre, Pa.	750,000	York (Second Contract)	750,000	St. John's, Newfoundland	250,000
St. Catherines (Second Cont.)	250,000	Rochester (Second Contract)	500,000	Brantford (Second Contract)	400,000
		Newport (Mon.)	250,000	Smethwick (Second Contract)	500,000
		Tokio, Japan	1,000,000	Pontypridd	250,000
				Montreal (Third Contract)	1,800,000

And, in addition, COAL GAS PLANTS at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

CURRENT SALES OF GAS PRODUCTS.

Week ending April 27.

Prompt business continues quiet in London, chiefly because makers have sold their output for this season; but inquiries for all products for forward are encouraging. Pitch for next season is 32s. net; and for prompt, benzol is 9⅛d. to 9¾d. net. For 60's crude carbolic 1s. 9½d. has been refused, and 1s. 9¾d. net is asked. Ordinary London creosote is 2d. to 2¼d. net. Crystal carbolic acid is firmer at 6¼d. for 39°-40°. Sulphate ammonia in large lots is difficult to obtain for early delivery, and is still quoted at £12 10s. on Beckton terms.

LIVERPOOL, *April* 27.

Sulphate of Ammonia.

There has been improved demand for immediate delivery, and in some cases a slight advance has been paid on the west coast; but, in the main, supplies have been ample to cover requirements. The closing quotations are £12 3s. 9d. per ton f.o.b. Hull, £12 6s. 3d. to £12 7s. 6d. per ton f.o.b. Liverpool, and £12 7s. 6d. per ton f.o.b. Leith. Home demand continues to be satisfactory. The forward position is unchanged, excepting that some of the smaller makers show a disposition to meet buyers. Buyers, however, continue to suggest impossible prices, or to hold off altogether; so that no important business has transpired. The larger makers seem to be waiting developments, the present attitude of buyers affording no encouragement to negotiations.

Nitrate of Soda.

This article is firm in all positions, and, in the absence of stocks, the spot price is nominally 12s. per cwt.

LONDON, *April* 28.

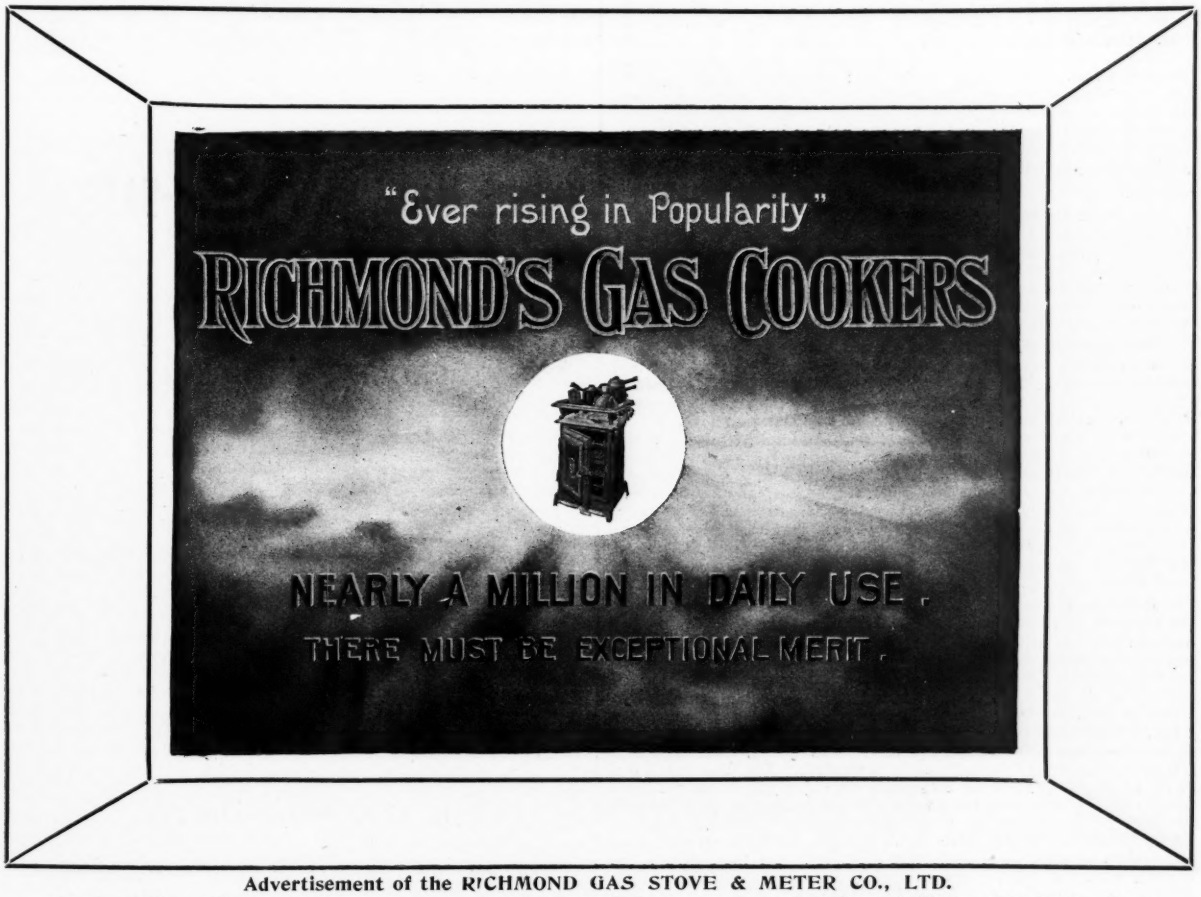
Tar Products.

Markets have been very quiet during the past week, and there really has been very little actual business doing. In pitch, the position remains somewhat uncertain, doubtless owing to the labour troubles in the North of France, though this should have a beneficial effect upon the Belgian market for briquettes—in fact, some considerable quantity has been sold during the past few days at fairly good prices for September-December delivery to Antwerp. So far as London is concerned, manufacturers still quote 30s. to 32s.; but dealers are prepared to accept considerably under these prices for both prompt and forward delivery. In Lancashire, there does not seem to be very much doing; and prices in Liverpool and Manchester appear inactive just at present. There is little or no doubt that the position may be more defined early in May, but certainly at present it does not seem at all brilliant, especially for early delivery. Benzol is decidedly quiet. In 50 to 90 per cent., consumers are not prepared to pay more than 10d.; but makers ask 10¼d. to 10½d. for April-June delivery. In 90 per cent., there appears to be an absence of business, and the price remains at about 9⅝d. to 9¾d. according to position. Toluol also remains unchanged. They are still buyers at 1s. 0⅛d. to 1s. 1d. for prompt; but there is little or nothing offering, and makers do not care to sell forward. Solvent is quiet except for prompt delivery of actual London make for home consumption, for which there is a fairly good demand. Makers in the North appear rather more anxious to sell forward, and there is certainly more heavy naphtha offering in several quarters. Carbolic continues very steady, and there is a good business doing in 60's at 1s. 9¼d. and 1s. 9½d. for prompt; while one of the largest manufacturers in the North of England advises having declined 1s. 9¾d. for July-December. In crystals, it is reported that there are several inquiries now in the market from Russia; but prices do not appear to have transpired, and values remain stationary. There does not seem to be any interest taken in anthracene just at the moment, and prices are purely nominal. There is very little doing in creosote. London makers are very firm in their ideas, and are not inclined for forward business except at figures which show an advance on existing prices. Yorkshire makers appear well sold, and are not prepared to offer for forward delivery at prices ruling for prompt. In Lancashire, there is no business to report, and the position remains unchanged.

The average values during the week were: Tar, 16s. to 21s. Pitch, London, 27s. 6d. to 28s.; east coast, 26s. 6d. to 27s.; west coast, 24s. 6d. to 25s. Benzol, 90 per cent., 9⅝d. to 9¾d.; 50-90 per cent., 10d. to 10⅛d. Toluol, 1s. 0⅛d. to 1s. 1d. Crude naphtha, 4d. to 4¼d.; solvent naphtha, 1s. to 1s. 0⅛d.; heavy naphtha, 11d. to 11½d. Creosote, London, 1¾d.; North, 1 7/16d. to 1½d. Heavy oils, 2¼d. Carbolic acid, 60 per cent., 1s. 9½d. to 1s. 10d. Refined naphthalene, £4 10s. to £8 10s.; salts, 19s. to 20s. Anthracene, "A" quality, 1½d. to 1⅝d.; "B" quality, unsaleable.

Sulphate of Ammonia.

The market has been quiet during the past week, and there is an absence of business to report, except in small parcels at one or two ports for immediate shipment. So far as London makers are concerned, they still quote nominally £12 10s.; but there is no doubt they would accept under this figure—in fact, it is reported that one of them has done so, which is probable, seeing that there are sellers upon Beckton terms at £12 3s. 9d. to £12 5s. In Hull, there is very little doing. Small transactions are reported at £12 3s. 9d. to £12 5s. according to position and quality. The market continues steady in Leith. Makers are asking £12 7s. 6d.; but so far as I can learn, consumers have up to now refused to pay more than £12 5s. Consequently no business has resulted just at present in prompt or forward. In Liverpool, transactions are limited; but a few small lots have changed hands at £12 5s. to £12 6s. 3d. for early shipment.



Advertisement of the RICHMOND GAS STOVE & METER CO., LTD.
London Offices and Show-Rooms: 132, Queen Victoria Street, E.C. General Offices and Works: Warrington, &c.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The continuance of cold weather in this part of the country has had the effect of keeping up the demand for house coal. It has not, however, been sufficient to exercise any change in prices, which remain unaltered; and in the opinion of competent judges there is not likely to be any variation for the next six months. For round steam coal there is a strong inquiry. With regard to engine fuel, the recent increase of 5d. per ton at the Manchester Exchange has been adopted by the Wigan district collieries, and may be said to be general throughout the country. The demand for this class of fuel continues brisk. Gas coal and cannel are moving away under ordinary conditions. New contracts are being entered into with gas manufacturers and municipal and other local authorities, some of which are being concluded at rather better prices than last year. There is a moderate demand for coke, and more inquiry for shipping coal, which commands slightly better prices than for some months past. Average quotations at the pits are: Best house coal 13s. to 14s., second qualities 12s. to 13s., common 9s. to 10s., steam and forge 8s. to 9s., best engine fuel 7s. 11d. to 8s. 9d., best slack 6s. 9d. to 7s. 9d., medium 6s. 6d. to 7s. 6d., common 5s. 6d. to 6s. 6d. Coal for shipping on the Manchester Canal is 9s. 6d. to 10s. 6d.

Northern Coal Trade.

There is a fuller, but still rather irregular, trade in coals being done in the north-eastern district. The demand from France has continued, though it is less pressing; and there is also setting in the Baltic trade, which is one of the chief of those that are supplied from this district. On the other hand, with the end of April, there is the usual falling off in the consumption of certain kinds of coal which will be in lessened use for perhaps four months to come. Steam coals are more active, and exports are heavy; while the lessened pressure of the demand that arose from the French strikes has made prices more regular and a little more normal, though sales are interfered with at present by the doubts as to the prolongation of the coal-tax. Best Northumbrian steams are 11s. 6d. per ton f.o.b., seconds are 10s. 6d., and steam smalls are scarce at 7s. In the gas coal trade, the demand is fair; for though the shipments to the large home consumers are less, there is now more being sent to foreign ports, and this increase should continue. For occasional cargoes, the demand is stronger; and though the supply of such is more than it was, the price is firm—Durham gas coals being quoted from about 9s. 3d. to 10s. 3d. per ton, according to quality, f.o.b. The contracts that have been referred to are being rather slowly made; the increased French demand having stiffened the prices, so that for some of the best kinds of gas coals 1s. per ton above last year's quotations is rather firmly made. In coke, the market is steadier; and for gas coke, with a diminished output, the quotation is steady at about 10s. 6d. to 10s. 9d. per ton f.o.b.

Scotch Coal Trade.

Trade is very active and bright in prospect, now that the Baltic has been declared open for navigation. Traders are holding themselves in readiness for a large development of Russian business this year. The most that can be said of prices is that they are firm, but are, as yet, not advancing. The quotations are: Main, per ton, f.o.b. Glasgow, 7s. 9d. to 8s.; ell, 9s. to 10s. 3d.; and splint, 8s. 3d. to 9s. 6d. The shipments for the week amounted to 291,867 tons—a decrease upon the previous week of 22,961 tons, but an increase upon the corresponding week of 32,672 tons. For the year to date, the total shipments have been 3,861,646 tons—an increase upon the corresponding period of 430,952 tons.

Gas-Meter Testing at Manchester.—In his thirteenth annual report to the Manchester City Justices, Mr. S. Dyson, the Meter Inspector, stated that 46,034 meters were tested during the past twelve months; the fees amounting to £1697. The number rejected was 790. A small profit on the working of the department is shown, instead of the annual loss which was incurred some time ago. Mr. Dyson expressed the opinion that the system of "double tests" had been vindicated.

New Gas-Works for Tavistock.—The opening of the new gas-works at Tavistock will take place on the 16th inst., when Mr. J. W. Buckley, Assoc.M.Inst.C.E., the Gas Engineer to the Devonport Corporation, and Consulting Engineer to the Tavistock Gas Company, will formally hand over the works to the Directors. The Chairman (Mr. W. T. Doble) will turn on the gas from the new holder into the town. Those present will then inspect the works, and afterwards, by invitation of the Contractors (Messrs. Willey and Co., Limited, of Exeter), partake of luncheon at the Bedford Hotel. Mr. A. Francis, who has for many years so successfully filled the position of Manager and Secretary, having expressed his desire to be relieved of a portion of his duties on the starting of the new works, the Directors have arranged for him to continue the secretarial duties, and have appointed, out of about 70 applicants, Mr. C. Stapleton, of Plymouth, as the new Manager.

Rotherham Gas Supply.—In his annual report on the finances of the borough of Rotherham, Mr. C. H. Moss, the Comptroller and Auditor, alluding to the gas-works, says the results of this department show a very satisfactory improvement. The income from the sales of gas has improved to the extent of £1695; the increase being principally from automatic meters. The sale of residuals, at £10,066, also shows an increase of £861. Manufacturing charges show a decrease of £855; the principal reduction being in cost of coal. The repairs and depreciation have been liberally allowed at £6155, and include a provision for some extra overhauling of services. The final result is a gross profit of £17,458 as compared with £15,533 in the previous year. After giving away the gas for the public lighting (at a reduced figure of £1964), the surplus at the disposal of the Committee is £5791. These satisfactory figures have, in his opinion, not been arrived at by any system of starving or neglecting the plant. On the contrary, the amount expended on repairs during the year has been £740 larger than the corresponding item in the previous year; extra provision has been made for renewing services, &c.

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Reduction in Price at Gosport.—A reduction in the price of gas has been announced by the Directors of the Gosport Gas Company. The charge to ordinary consumers has been lowered from 3s. 9d. to 3s. 6d. per 1000 cubic feet, and that to consumers using automatic meters from 4s. to 3s. 9d.; while the price of gas employed for motive power will in future be 3s. instead of 3s. 3d. per 1000 cubic feet—an all-round reduction of 3d.

The Geltsdale Water Scheme.—At the last monthly meeting of the Carlisle City Council, the announcement was made that the water-works which have been in progress for some years in Geltsdale, for the purpose of supplying the city with water by gravitation, would be so far completed by the second week in July as to enable the Corporation to turn on the water and discontinue the existing supply, which is obtained from the River Eden.

Poor Electric Lighting at Chelmsford.—The Chelmsford Lighting Committee have been recommending the Council to withhold payment of £132, the charge for the arc lamps, and that the Electric Lighting Company he asked what allowance they propose to make for the unsatisfactory working of their lamps during the past quarter. Messrs. Crompton and Co., who supplied the lamps, express regret that they have not come up to expectations, and admit that certain troubles have developed which they did not anticipate. Alderman Whitmore summed up the matter in a very few words, when he suggested "that the Committee should have power to negotiate with the Gas Company for the public lighting of the main streets, and then perhaps the Council might succeed in getting a proper light."

Kimberley Water-Works Company, Limited.—The report of the Directors of this Company for the year 1905 shows a balance of £51,818. After providing £4417 for interest on debenture stock and £936 for depreciation, the net profit, including £1417 interest on investments, is £47,881. Out of this sum, the Directors propose to make provision for debenture stock expenses £5000, to write off £12,131 from construction, to transfer £15,000 to the contingency fund, and to pay a dividend of 5 per cent., absorbing £15,750. The consumption of water for the year was 246,883,652 gallons; being an increase of 95,757,983 gallons as compared with the consumption for 1904. Since the accounts were made up, the 6 per cent. debenture stock of £73,530 has been paid off, and £75,000 of 4 per cent. debenture stock created, of which £40,000 has been issued at 98. The annual interest charge has thus been reduced from £4411 to £1600.

Buenos Ayres (New) Gas Company, Limited.—The report of the Directors of this Company for the past year states that the profit, after writing off bad debts and making provision for doubtful ones, is £59,527, to which has to be added £17,394 brought forward; making a total of £76,921. An interim dividend was paid in October last of 6s. per share, tax free; and a final dividend, at the rate of 8s. per share, making 7 per cent. for the year (free of tax), is proposed—leaving a balance of £20,550 to be carried forward. Out of the year's revenue, £23,683 was expended on the upkeep of the works, mains, &c. Towards the end of the year a severe strike again took place at the works of the Company, which unfortunately lasted for a period sufficiently long to occasion considerable loss. It was, however, completely defeated owing to the energetic measures taken. With regard to the South Barracas Gas and Coke Company (noticed elsewhere), the Directors state that the business is developing very satisfactorily.

Sales of Gas Shares and Stocks.—In response to their invitation for tenders for 600 "B" shares, of £5 each, which recently appeared in the "JOURNAL," the Pinner Gas Company, Limited, received tenders for very nearly twice this number. No share was allotted at less than £7; and applicants who tendered this amount were allotted only about one-third of the number of shares applied for. Last week there was sold by auction £1500 worth of new ordinary stock in the Leighton Buzzard Gas Company, divided into 30 lots, each of £50 stock. At the present time, a dividend of 10 per cent. per annum is paid upon the Company's original stock, and 7 per cent. upon the new ordinary stock. The lots in question were disposed of at prices ranging from £73 10s. to £74 10s. each; and the total sum paid for the £1500 stock amounted to £2218 10s., or an average of £73 19s. per lot. The West Ham Gas Company have just made new issues of ordinary and debenture stocks at from £106 to £111 per £100 of stock.

An Electricity Meter and a Rude Awakening.—A recent report of the Finance Committee of the Newport (Mon.) Guardians stated that an account had been received from the Corporation Electricity Department for £478; being an amount due from the Guardians in respect of electric light supplied to the workhouse between Aug. 16, 1901, and Nov. 24, 1905. Owing to an error in the attachments to the meter, only one-half of the actual consumption of current for this period had been registered; and the Guardians had consequently been undercharged to the extent of £478. The Electricity Department offered to reduce the amount to £396; this sum being based on the scale of charges at present in operation. The Committee were satisfied that the facts were correct, and recommended that, subject to the consent of the Local Government Board being obtained, the amount of £396 should be paid. This the Guardians have agreed to, though it must have sadly upset their views with regard to the cost of electricity.

Water Scheme for Ilkley.—Professor Kendall, of the Leeds University, was some time ago requested by the Ilkley Urban District Council to inspect Ilkley Moor, with a view to the augmentation of the town's water supply by means of boring operations; and he has now presented his report. He suggests as the area of operations a portion of the moorland known as Crawshaw Moss, situated about 1200 feet above sea-level; the gathering ground for the stream running through Heber's Ghyll. There a shaft should be sunk 250 feet deep; and from this the water could be obtained by pumping, or an adit or tunnel having an outlet under Woodhouse Crag, to the west of Heber's Ghyll, could be constructed. This adit would be 1300 yards long; and if a substantial bulkhead were constructed at the outlet, it might be made to serve the purposes of a storage reservoir, with a capacity of half-a-million gallons. The adit scheme, Professor Kendall estimates to cost £10,000. Pumping, though less expensive in the first instance, would cost more in the long run, through the continual working expenses.

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Free Lectures in Cooking by Gas.—Seven ironmongers of Hornsey who have organized a local exhibition of gas cooking, heating, and lighting appliances, have issued invitations to the residents to attend a series of free lectures in cooking by gas to be held at various places in the district daily up to the 5th inst. inclusive. The demonstrations are being given daily at 3 and 7 p.m.; and appliances of the most modern type are used.

Manchester Water Supply.—The annual report of the Manchester Water Committee states that the amount of estimated available rates outstanding on March 31, out of a gross sum of £63,000, was £32, and of rentals £120, out of a gross sum of £249,000. A full supply of water was maintained during the year; the daily consumption reaching an average of about 35¼ million gallons. The necessity for providing additional storage in the near future is, the Committee say, apparent. It is intended to carry out important improvements at the Denton reservoirs; and the preparations for these are now in hand. The Thirlmere works are complete for the delivery of 20 million gallons of water a day, and have more than fully met all expectations. The work of constructing the new road and the drainage of Shoulthwaite Moss has been proceeded with during the year, as far as circumstances would permit. The lining of the aqueduct at Hutton has also made fair progress; over two-thirds having been completed.

Shanklin Water Supply.—The Shanklin District Council purpose carrying out a water scheme which is estimated to cost £14,300, and a Local Government Board inquiry was held in regard to the matter on Tuesday, by Major C. E. Norton, R.E. The parishes affected by the supply are Bonchurch, Gatcombe, Godshill, Wroxall, and South Arreton. It was stated that by one scheme 4½ acres of land were to be acquired at Luccombe, in addition to half-an-acre for the construction of a catch-pit into which water could be pumped from a low-level reservoir; while another scheme was the acquisition of a source of water on land at Chillerton, belonging to Sir Charles Seely, to whom the Council would have to pay a royalty of 2d. per 1000 gallons for the water used. It was urged that the yield from Luccombe would be inadequate for the needs of the district, and evidence was given against the scheme; while the Council were condemned for desiring to purchase water at 2d. per 1000 gallons for which the rural parishes would be charged 10d. per 1000 gallons. At the close of the inquiry, the Inspector visited the sites.

At Heywood, the profits on the gas undertaking for the past year amount to £2052, against £1463 for the previous twelve months.

The West Bromwich Gas Committee report that the sales of gas during the financial year ending March 31 amounted to 323,815,654 cubic feet, and the gas-rental to £41,090.

The Directors of the Oriental Gas Company, Limited, have resolved to pay an interim dividend at the rate of 3½ per cent., free of income-tax, on account of the year ending the 30th prox. This is at the same rate as last year.

Messrs. George Newton, Limited, of Oldham, have recently received an order for the supply of a portion of the automatic dry meters required by the Shirebrook, Southwell, Draycott, and Farnsfield Gas Companies.

Mr. Lloyd George, the President of the Board of Trade, has consented to conduct, on the 12th inst., the opening ceremony in connection with the new water-works in the sea-side resort of Nevin, on the Lleyn Peninsula, North Wales, which have been constructed at a cost of £4000.

Mr. James Parker, M.P., owing to the claims of his parliamentary duties, has resigned the Chairmanship of the Halifax Water Committee, which he has held since 1902. The Committee have decided to ask Alderman Josiah Wade, who relinquished the position when appointed Mayor, to resume the office.

Last Sunday week, the Albert Hall, Nottingham, was gutted by fire; the damage done being estimated at £25,000. The building, which was one of the largest of its kind in the Midland Counties, was acquired by the Wesleyans about five years ago, and has been used mainly for mission services. The fire is supposed to have been caused by the fusing of an electric wire.

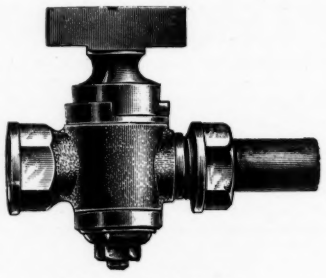
The profit on the past year's working of the Brighouse gas undertaking amounts to £3010, the whole of which is to be devoted to the relief of the rates. The members of the Gas Committee, however, feel that this is unfair to the undertaking, and in future years they intend to claim that a proportion of the profits shall be devoted to the creation of a bank balance for the Gas Department.

Messrs. Willey and Co., Limited, of Exeter, have been favoured with an order from one of the London Gas Companies for nine Livesey washers—four of 5 million cubic feet capacity each, and five of 3 millions each—to be delivered and erected complete. The firm have recently finished some Livesey washers of 5 million cubic feet capacity for the Birmingham Corporation, and have also in hand large washers for other corporations.

It is rumoured that a London Company are making inquiries as to a suitable site or premises in Llanelly for a gas-stove manufactory. It is intended to have works of considerable size, which will give employment to a good number of men. The Chairman of the Llanelly Urban District Council (Mr. D. R. Edwards) lately drew attention to the advantages of the place for the erection of new works. He remarked that, as a member of the Harbour Trust, he would gladly propose that the splendid land that they owned on the foreshore should be given to manufacturers almost for nothing. They had also other inducements to offer these large firms. They had the best anthracite coal near at hand; and as the best coal for motive power in future would be anthracite, he thought that this fact should be more widely known. Llanelly could offer far more inducements to large manufacturers than any other seaport town in South Wales. Then the Council were the owners of the water-works; and they could safely say they were the owners of one of the finest watersheds in Wales. They could supply cheaper and better water for manufacturing purposes than any other town in the United Kingdom.

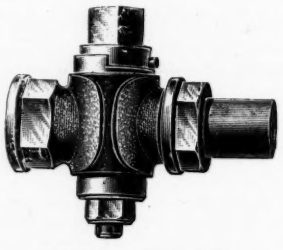
MAIN TAPS.

No. 119.



ROUND GASWAY.

No. 61.



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An exhibition of the gas appliances by Messrs. R. & A. Main, Limited, was held in the Masonic Hall, Newburgh (Fife), last week. It was opened on Tuesday by ex-Provost Anderson, the Chairman of the Gas Company, who said that they had reduced the price of gas for cooking to 5s. per 1000 cubic feet—a figure which did not cover the cost of manufacture—and the Company were willing to fit up gas-cookers, and to hire them out at a very low rent. Mrs. Waldie, of the Glasgow School of Cookery, was the lecturer.

The Plymouth and Stonehouse Gas Company are holding a special exhibition of cooking and heating stoves and other appliances for the economical use of gas. It has been arranged on the premises in Old Town Street, in the centre of Plymouth, where for several years past the Company have had an excellent show-room. With a view to further popularizing the use of gas, arrangements have been made for a series of lectures by Mrs. Emilie K. Deane on the use of gas for domestic purposes, with practical demonstrations in cookery.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ASSISTANT GAS ENGINEER. Whitehaven Gas Company. Applications by May 9.
MANAGER (SMALL WORKS). Hayfield Gas Company.
SHOW-ROOM MANAGER AND SALESMAN. Gosport Gas Company. Application by May 7.
MANAGER (GAS METER TRADE). Sell's Advertising Offices.
ASSISTANT TO QUALIFY. Keith and Co., Edinburgh.
GAS-FITTER. Dartford Gas Company.
GAS-FITTER. No. 4594.
WASTE INSPECTOR. Colne Valley Water Company.

Partner Wanted. No. 4593.

Plant (Second-Hand) for Sale.

BARGES. No. 4591.
GASHOLDER. S. Cutler and Sons, Milwall.
PURIFIERS AND GASHOLDER. Yorktown and Blackwater Gas Company.

Company Meetings.

PORTSMOUTH WATER COMPANY. Offices, May 24. Three o'clock.

Stocks and Shares.

BRIGHTON AND HOVE GAS COMPANY. May 8.
CHELMSFORD GAS COMPANY. May 8.
CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY. May 8.

Stocks and Shares—*continued.*

CHIPPENHAM GAS COMPANY. May 18.
ENFIELD GAS COMPANY. May 8.
FELIXSTOWE GAS COMPANY. May 8.
HARROW AND STANMORE GAS COMPANY. May 8.
LOWESTOFT WATER AND GAS COMPANY. May 8.
NEWCASTLE AND GATESHEAD WATER COMPANY. May 8.
SEVENOAKS WATER COMPANY. May 21.
SOUTHEND GAS COMPANY. May 8.
SUTTON GAS COMPANY. May 22.

TENDERS FOR

Benzol.

HEYWOOD GAS DEPARTMENT. May 15.
LEIGH GAS DEPARTMENT. Tenders by May 12.

Coal and Cannel.

BANGOR (CO. DOWN) GAS DEPARTMENT Tenders by May 15.
BARROW-IN-FURNESS GAS DEPARTMENT. Tenders by May 16.
HEYWOOD GAS DEPARTMENT. Tenders by May 15.
LEIGH GAS AND WATER DEPARTMENT. Tenders by May 12.
NORTHWICH GAS COMPANY. Tenders by May 10.
RICHMOND (SURREY) WATER DEPARTMENT. Tenders by May 28.
SOUTH STAFFORDSHIRE WATER COMPANY. Tenders by May 21.

Oil for Gas Making.

BARROW-IN-FURNESS GAS DEPARTMENT. Tenders by May 16.

Pipes (Iron and Lead).

LEIGH GAS AND WATER DEPARTMENT. Tenders by May 12.

Purifiers and Grids.

HAVERFORDWEST GAS DEPARTMENT. Tenders by May 14.

Lime.

LEIGH GAS AND WATER DEPARTMENT. Tenders by May 12.

Meter (Station).

SALFORD GAS DEPARTMENT. Tenders by May 16.

Sulphuric Acid.

LEIGH GAS DEPARTMENT. Tenders by May 12.

Tar and Liquor.

LEIGH GAS DEPARTMENT. Tenders by May 12.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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MEADE-KING, ROBINSON, & CO.
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 8, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

GAZINE—A radical Solvent and Preventative of Naphthalene deposits, which has been used for many years on the Continent for the cleaning of Mains and Services, and is now being adopted in England. It is also used for the Enrichment of Gas, and has an Illuminating Value of double that of 90 per cent. Benzol.
Supplied by C. BOURNE, 120, Manor House Road, NEWCASTLE-ON-TYNE.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
Telegrams:—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

TEMPERLEY TRANSPORTERS
FOR Rapid and Economical Handling of Coal and Coke in Gas-Works.
Next Illustrated Advertisement will appear on May 29.
TEMPERLEY TRANSPORTER COMPANY,
72, BISHOPSGATE STREET WITHIN, LONDON, E.C.
Telephone: 365 LONDON WALL. Telegrams: "TRANSUMO."

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

GASHOLDER PAINTING.
PAINTING Work for all kinds of Gas-Works Plant, Roofs, Bridges, &c., undertaken by Contract or otherwise.
FREDERICK BOYALL, 31, Regent's Row, DALSTON, N.E.

TAR AND LIQUOR WANTED.
Best Prices paid.
DENT AND CO.,
Ouse Chemical Works, SELBY.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

TO WATER AND GAS COMPANIES REQUIRING CAPITAL.
THE Water and Gas Debenture Share
Investment Trust, Limited, of 37, High Street, Tunbridge Wells, are prepared to Invest £10,000 Capital in above, and also to Underwrite Progressive Water and Gas Companies' issues.

OXIDE OF IRON.
(NATURAL.)
BALE & CHURCH will be pleased to send Quotations and Samples on application.
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT for all Retort and Furnace work.
PAINT for Gasholders, Purifiers, &c.
5, CROOKED LANE, LONDON, E.C.

SULPHURIC ACID.
SPECIALLY prepared for the Manu-facture of SULPHATE OF AMMONIA.
SPENCER, CHAPMAN, & MESSEL, LTD.
(with which is amalgamated WM. PEARCE & SONS, LTD.
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone 341, AVENUE.

GLASS SHADES of every description, for all kinds of Interior GAS LIGHTING.
Illustrated sheets on application.
JOHN WALSH WALSH,
SOHO AND VESTA GLASS WORKS, BIRMINGHAM.
Telegrams: "VESTA, BIRMINGHAM."
National Telephone: No. 63.
London Show-Room: 4, HOLBORN CIRCUS, E.C.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

JOHN RILEY & SONS, Chemical Manu-facturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS ELLAND.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia. BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PATENTS AND TRADE MARKS PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; SUBJECT-MATTER of PATENTS," 6d. MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 248 Holborn.

THE Applicants who responded to Advertisement No. 4588, for a Rental Clerk, are THANKED for their Applications, and informed that the post HAS NOW BEEN FILLED.

APPLICANTS for the Appointment of GAS MANAGER to the Tavistock Lighting, Coal, and Coke Company, Limited, are THANKED, and informed that the POSITION IS NOW FILLED.

WANTED, Partner or Firm to take Half Share in further Developing a small Gas-Works in a growing and prospering Village. For Particulars, address No. 4593, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an Energetic young Man as GAS-FITTER, thoroughly Experienced in Fixing Cookers, Fires, and the Maintenance of Incandescent Burners. Wages, 30s. per week. Apply, by letter, to the MANAGER, Gas Company, DARTFORD.

WANTED, a Manager for a Small Works and to keep Accounts. Must thoroughly understand Gas Making and Fitting. Salary to commence at £75. Applications, by letter only, not later than May 5, to the HAYFIELD GAS COMPANY, Hayfield, near STOCKPORT.

GAS-METER TRADE.

MANAGER wanted. Must be tho- roughly Efficient, with knowledge of Automatics and must be capable of Taking Entire Control of the Department. Reply 1242, Sell's Advertising Offices, London, E.C.

WANTED, by a large Railway Company, a Smart, Active Young Man to train under a Gas Manager with a view to Qualifying for a Gas Manager's Appointment. Address, stating Age, References, Qualifications, and Salary expected, to No. 350, KEITH AND CO., Advertising Agents, EDINBURGH.

WASTE Inspector Wanted, who has had Experience with the Deacon System of Waste Prevention. A Practical Plumber preferred. Application, stating Age, Qualifications, Experience, and Wages required, to be made by letter only, to the SECRETARY, Colne Valley Water Company, New Bushey, WATFORD.

GAS-FITTER Wanted by a Suburban Gas Company. Applicants must be Experienced and First-Class Fitters, and are desired to state Wages required, as well as the General Particulars necessary with regard to them. Apply, by letter, to No. 4594, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a smart, well-informed Man, of good Address, as SHOW-ROOM MANAGER and SALESMAN. Must be accustomed to the control of workmen, the advising of Consumers, preparing Estimates, and have Practical Experience and thorough knowledge of all latest Gas Appliances. Commencing Wages, £2 2s. per week. Apply, by letter, stating Age, Experience, &c., enclosing *copies* of Three Testimonials, to ALFRED LOACH, Secretary, Gosport Gas and Coke Company, GOSPORT, not later than the 7th of May.

WANTED by the Whitehaven United Gas Company, Limited, an ASSISTANT GAS ENGINEER. Must be a good Carbonizer, accustomed to Sulphate Ammonia Making, well up in the usual routine of a Gas-Works, and be able to take full charge on and off the Works. Salary £110 per annum. Applications, endorsed "Assistant-Engineer," stating Age, Experience, and enclosing Three recent Testimonials, to be sent to me not later than the 9th of May next.

J. H. STUDHOLME,
Manager and Secretary.

WANTED, Copper Scrap, 72s.; Brass, 48s.; Zinc, 16s.; Lead Ashes, 8s. Also old Wet Gas-Meters bought. ROSSE WORKS, Leeds Road, BRADFORD.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere. J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

BARGES for Sale—Owing to the illness of the Proprietor, a Fleet of Steel and Wooden Barges suitable for Gas Companies, Contractors, &c., to be disposed of. All in first-class condition. Apply, by letter, to No. 4591, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE London and Provincial Gas-Works Corporation, Parliament Chambers, Westminster, are prepared to PURCHASE outright for Cash a GAS-WORKS where, by the introduction of additional Capital, there would be scope for further extension and development. Address, with full Particulars, as above.

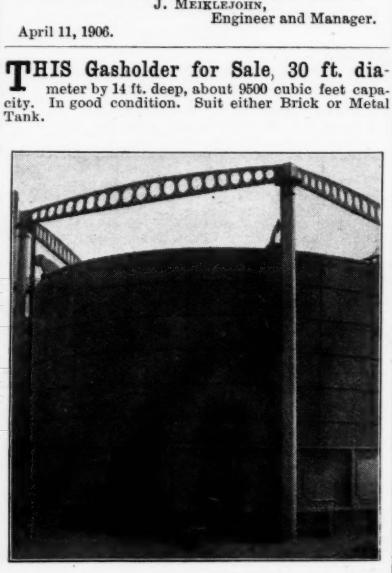
GAS PLANT FOR SALE.

THE Yorktown and Blackwater Gas Company have FOR SALE: Two 10-feet square PURIFIERS, with 6-inch Connections and Valves complete, in first-class condition. Also a small GASHOLDER, 25 feet diameter and 12 feet deep, with Columns, Chains, and Balance-Weights complete (without Tank). Any reasonable Offers will be considered. For further Particulars apply to the undersigned.

J. MEIKLEJOHN,
Engineer and Manager.

April 11, 1906.

THIS Gasholder for Sale, 30 ft. dia- meter by 14 ft. deep, about 9500 cubic feet capacity. In good condition. Suit either Brick or Metal Tank.



Existing Cast-Iron Tank is not for Sale, but a cheap Steel Tank will be quoted if required. SAML. CUTLER AND SONS, Millwall, LONDON. No. 217.

NORTHWICH GAS COMPANY.

THE Directors of the Northwich Gas Company invite TENDERS for the supply of about 7000 Tons of GAS COAL during the Year ending June 30, 1907. Full Particulars and printed forms of Tender may be had on application to the undersigned. Tenders, endorsed "Coal," are to be sent in addressed to the Chairman by Thursday, May 10, 1906.

SAML. S. MELLOR,
Manager and Secretary.

Gas-Works, Northwich,
April 20, 1906.

TENDERS FOR COAL.

THE Urban District Council of Bangor, County Down, invite TENDERS for supplying about 3000 Tons of best screened GAS COAL, which must be freshly wrought, well screened, and free from Sulphurous Pyrites, and other objectionable matter. Coal to be delivered into Carts at Bangor Quay at such times and in such quantities as may be required from June 1 next. Parties tendering to name the Pit from which the Coal offered is raised. Tenders should be accompanied by Analysis, placed in sealed envelopes, marked "Tender for Coal," and must reach me not later than Tuesday, May 15 next. No Tender Forms issued. The Council do not bind themselves to accept the lowest or any Tender, and will require security for the due and faithful performance of the Contract.

JAMES MILLIKEN,
Clerk of the Council.

Town Hall, Bangor,
County Down, April 25, 1906.

COUNTY BOROUGH OF SALFORD.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the Supply and Erection of a STATION METER (50,000 cubic feet per hour capacity) at their Bloom Street Works. The Drawings may be seen and Copies of the Specification and Form of Tender obtained (for which a charge of £1 1s. will be made, to be returned on receipt of a *bond-fide* Tender) on application to Mr. William W. Woodward, Engineer, Gas Offices, Bloom Street, Salford. Sealed Tenders, endorsed "Tender for Meter," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered to me not later than Three p.m. on Wednesday, the 16th of May, 1906.

L. C. EVANS,
Town Clerk.

Town Hall, Salford,
April 25, 1906.

BOROUGH OF BARROW-IN-FURNESS.

SUPPLY OF GAS OIL.

THE Corporation are prepared to re- ceive TENDERS for the supply of about 350 to 450 Tons of OIL, suitable for the Manufacture of Carburetted Water Gas, delivered free at the Gas-Works Siding, in such quantities and at such times as may be required during the period ending the 30th of June, 1907. Sealed Tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Oil," to be delivered at the Town Clerk's Office, not later than Twelve o'clock noon on Wednesday, the 16th day of May, 1906. The lowest or any Tender not necessarily accepted.

By order,
C. F. PRESTON,
Town Clerk.

Town Hall, Barrow-in-Furness.

BOROUGH OF BARROW-IN-FURNESS.

SUPPLY OF COAL AND CANNEL.

THE Corporation are prepared to re- ceive TENDERS, on Forms to be obtained at the Office of the Gas and Water Manager, for the supply of screened GAS COAL and CANNEL for the Year ending the 30th of June, 1907. Tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal," to be delivered at the Town Clerk's Office, not later than Twelve o'clock noon on Wednesday, the 16th day of May, 1906. The lowest or any Tender not necessarily accepted.

By order,
C. F. PRESTON,
Town Clerk.

Town Hall, Barrow-in-Furness.

BOROUGH OF LEIGH.
(GAS DEPARTMENT.)

THE Gas and Water Committee of the above Corporation invite TENDERS for the removal of the surplus TAR produced at their Works during the Year ending June 30, 1907. Approximate quantity, 850 Tons. Forms of Tenders and any further Particulars may be had on application from the undersigned, to whom all Inquiries must be addressed. Sealed Tenders, endorsed "Tender for Tar," must be delivered to Mr. Stanley Wilson, Town Clerk, Town Hall, Leigh, Lancashire, on or before Twelve o'clock noon on Saturday, the 12th day of May, 1906. The Corporation do not bind themselves to accept the highest or any Tender.

JAMES GIBSON,
Engineer and Manager.

Gas and Water Offices,
Leigh, Lancashire,
April 24, 1906.

BOROUGH OF LEIGH.
(GAS AND WATER DEPARTMENTS.)

THE Gas and Water Committee of the above Corporation are prepared to receive TENDERS for the supply of the following goods—

1—14,000 Tons of Screened and Unscreened GAS COAL, COBBLES, NUTS, and SLACK.
2—LEAD PIPING (Gas and Water).
3—VITRIOL.
4—LIME.
5—BENZOL.
6—WROUGHT-IRON TUBES and FITTINGS.
7—2-inch, 3-inch, and 4-inch CAST-IRON PIPES and SPECIALS.

Forms of Tender may be had on application from the undersigned, to whom all Inquiries must be addressed; and all Offers must be made on the Official Forms, or they will not be considered. Sealed and endorsed Tenders must be delivered to Mr. Stanley Wilson, Town Clerk, Town Hall, Leigh, Lancashire, on or before Twelve o'clock noon on Saturday, the 12th day of May next. The Corporation do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right to divide any Tender.

JAMES GIBSON,
Engineer and Manager.

Gas and Water Offices,
Leigh, Lancashire,
April 24, 1906.

BOROUGH OF RICHMOND (SURREY) WATER-WORKS AND PUBLIC BATHS.

TENDERS FOR SMOKELESS WELSH STEAM COAL.

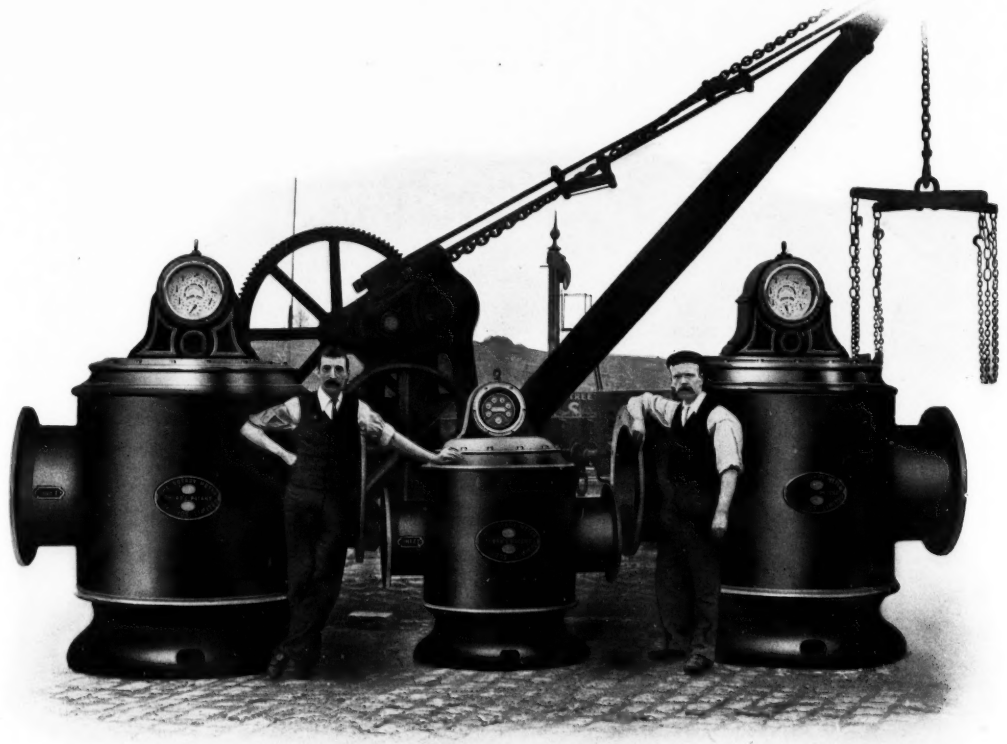
THE Town Council of the Borough of Richmond (Surrey) invite TENDERS for the supply of about 1450 Tons of best WELSH SMOKELESS COAL, to be delivered in barges of about 40 Tons alongside the Wharf opposite the Water-Works, Richmond, for One Year, from the 1st day of July, 1906, to the 30th day of June, 1907. The seam and district from which the Coal is to be supplied must be stated in the Tender. Particulars and Forms of Tender can be obtained from Mr. W. G. Peirce, Borough Water-Works Engineer, at the Water-Works. No Tender will be recognized unless it is made on the prescribed Form, properly filled up in every respect; and no expenses or claim will be allowed or paid to any person, whether tendering or not. The security stipulated by the Public Health Act, 1875, for the due performance of the Contract will be required, and the Contract and Bond will be prepared by the Town Clerk. Sealed Tenders, endorsed "Tenders for Welsh Coal," and addressed to the Chairman of the Water Committee, Borough of Richmond (Surrey), must be delivered at the Town Clerk's Office by Ten o'clock on Monday, the 28th of May, 1906. The Council do not bind themselves to accept the lowest or any Tender.

FREDK. B. SENIOR,
Town Clerk.

Town Clerk's Office,
Town Hall, Richmond (Surrey).

Advertisement Supplement to the "JOURNAL OF GAS LIGHTING," &c., May 1, 1906.

Preparing to ship Two 60,000 cubic feet per hour and One 30,000 cubic feet per hour Rotary Station Meters.



For Home and Abroad, Meters have been supplied, and are in course of erection, for the measurement of **213,000,000** cubic feet of Gas per day.

Quotations, Drawings, and Specifications, with fullest Particulars for any size of Installation, will be forwarded on application to

T. G. MARSH,

1, Mawson Chambers,

28, Deansgate, MANCHESTER.

Printed and Published by Walter King, at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, May 1, 1906.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of 12,000 Tons of COAL and 3000 Gallons of BENZOL.

Specification and Form of Tender may be obtained upon application to Mr. W. Whatmough, Gas Manager.

Sealed Tenders, endorsed "Coal," or "Benzol," to be sent to me not later than Tuesday, May 15, 1906.

By order,
GEO. G. BOUCHIER,
Town Clerk.

Municipal Buildings,
Heywood, April 26, 1906.

THE Haverfordwest Town Council in- vite TENDERS for the Supply, Delivery, and Erection, on Foundations provided by the Town Council, of Two GAS PURIFIERS, 11 feet square by 4 feet deep, inside measurement, with Two Sets of WOOD GRIDS for each, with the necessary Bearing Bars, Fasteners, Air Plugs, and Wrought-Iron Cover, $\frac{3}{8}$ inch thick.

The Contractor will not be required to do any Pipe or Valve Connections.

Tenders, endorsed "Purifiers," to be sent to the Town Clerk, Haverfordwest, by Monday, May 14, 1906.

Further Particulars may be obtained from
J. GIBBON,
Gas Manager.

Haverfordwest, April 26, 1906.

SOUTH STAFFORDSHIRE WATER-WORKS COMPANY.

TENDER FOR ENGINE SLACK.

THE Company are prepared to receive TENDERS for the supply of ENGINE SLACK, at their various Pumping Stations, for Twelve Months from the 1st of July, 1906.

Forms of Tender, giving Particulars as to the quantity of Coal to be delivered at the various stations, can be obtained on application to me.

Tenders, made out on the Forms provided, and endorsed "Tender for Slack," must reach me at latest by Twelve noon on Monday, the 21st of May, 1906.

H. ASHTON HILL, M.Inst.C.E.,
Engineer.

Paradise Street, Birmingham.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1902.

NOTICE is Hereby Given, that The NEW INVERTED INCANDESCENT GAS LAMP COMPANY, LIMITED, of 23, Farringdon Avenue, E.C., seek LEAVE TO AMEND THE SPECIFICATION OF LETTERS PATENT No. 5769 of 1900, granted to Josef Bernt and Emanuel Cervenka for "Improvements in or relating to Gas-Burners."

Particulars of the proposed Amendment were set forth in the "Illustrated Official Journal (Patents)" issued on the 19th of April, 1906.

Any person or persons may give NOTICE OF OPPOSITION to the Amendment (on Form "G") at the Patent Office, 25, Southampton Buildings, London, W.C., within One Calendar Month from the date of the said "Journal."

C. N. DALTON,
Comptroller-General.

BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY.

NOTICE OF HALF-YEARLY MEETING.

NOTICE is Hereby Given, that the next ORDINARY HALF-YEARLY GENERAL MEETING of the Shareholders of this Company will be held at the Company's Offices, Commercial Road, Portsmouth, on Thursday, the 24th day of May, 1906, at Three o'clock in the Afternoon, on the following Business:—

To receive the Accounts and Balance-Sheets to the 31st of March last, and the Directors' Report.

To declare Dividends.

To elect Directors and Auditor in the place of those retiring by rotation.

And for the transaction of the other Ordinary Business of the Company.

The REGISTER OF TRANSFERS WILL BE CLOSED from the 11th day of May, 1906, to the 24th day of May, 1906, both days inclusive.

Dated this 26th day of April, 1906.

By order of the Board of Directors,
J. L. WILKINSON,
Secretary to the Company.

CHIPPENHAM GAS COMPANY.

ISSUE OF £8000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK,

In pursuance of the powers of the Chippenham Gas Act, 1904.

MINIMUM PRICE, £100 PER CENT.

THE Directors of the Chippenham Gas Company give Notice that they will be prepared to receive, not later than Eleven o'clock a.m. on Friday, the 18th day of May, 1906, sealed TENDERS, addressed to the Directors of the Company, care of Messrs. Keary, Stokes, and White, Solicitors, Chippenham, for £8000 PERPETUAL DEBENTURE STOCK, to bear Interest at the rate of £4 per Centum per Annum, to be paid up in full on or before the 30th day of June, 1906.

The Interest on this Debenture Stock will have priority of payment over all Dividends on the Ordinary and Preference Stock.

Any amount, not being less than £20 or a multiple of £10 thereof, may be tendered for; and the Stock will be registered in the Company's Books in the names of the Purchasers or their nominees free of expense for Stamp Duty and Registration Fee.

Further Particulars, Conditions, and Form of Tender may be obtained of

MR. H. W. SAVILLE,
Secretary to the Company,
or of Chippenham;
Messrs. KEARY, STOKES, AND WHITE,
Chippenham,
Solicitors to the Company.

Dated the 21st of April, 1906.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY.

NEW ISSUE OF £3000 CONSOLIDATED ORDINARY STOCK,
AND
£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 8, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
LOWESTOFT WATER AND GAS COMPANY.

NEW ISSUE OF 400 ADDITIONAL ORDINARY £10 SHARES,

Ranking for a Maximum Dividend of 7 per cent. equally with similar Shares now receiving $5\frac{1}{2}$ per cent.;
ALSO
£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 8, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of Executors and other Owners.
GAS STOCKS AND SHARES
IN THE
BRIGHTON AND HOVE GENERAL GAS COMPANY,
FELIXSTOWE GASLIGHT COMPANY,
ENFIELD GAS COMPANY,
SOUTHEND GAS COMPANY,
HARROW AND STANMORE GAS COMPANY,
CHELMSFORD GASLIGHT AND COKE COMPANY.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 8, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SUTTON GAS COMPANY.

NEW ISSUE OF £7000 CONSOLIDATED ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 22, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

NEWCASTLE AND GATESHEAD WATER COMPANY.

TO be Sold by Auction, in the Board Room of the Company's Offices, Pilgrim Street, Newcastle-on-Tyne, on Tuesday, May 8, 1906, at Half-past Twelve o'clock precisely, by

Mr. CHARLES A. JOEL,

in such Lots as are provided for in the said Company's Acts of 1902—

FIFTY THOUSAND POUNDS FIVE PER CENT. PREFERENCE STOCK (1902).

Printed Particulars and Conditions of Sale may be had at the COMPANY'S OFFICES, and Messrs. GEORGE ARMSTRONG AND SONS, Solicitors, NEWCASTLE-ON-TYNE; or of the AUCTIONEER, 27, Northumberland Street, NEWCASTLE-ON-TYNE.

GEORGE SMITH,
Secretary and General Manager.

Newcastle-on-Tyne,
April 2, 1206.

NOW READY, THE SECOND EDITION OF

GAS COMPANIES'

BOOK-KEEPING.

A Practical Treatise on the Keeping of Gas Companies' Accounts.

BY
JOHN HENRY BREARLEY, and
BENJAMIN TAYLOR.

THE VOLUME CONTAINS TWO WORKS:
1—Gas Companies' Book-Keeping.
2—Useful Forms for Gas Undertakings.

Price Net: Complete, Cloth Bound, 12s. 6d.; Morocco Gilt, 18s.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

SEVENOAKS WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the Sevenoaks Water-Works Company, in pursuance of their Provisional Order of 1900, as confirmed by Act of Parliament, being desirous of increasing their Capital, have resolved to issue FIVE HUNDRED AND TWENTY 4 PER CENT. PREFERENCE SHARES of Ten Pounds each.

Tenders are hereby invited from the public for the same at not less than par value.

The present issue of Capital is made to provide for the completion of the Additional Pumping Plant, Reservoirs and Mains at Seal Chart, Stone Street, and Bitchet, now under construction.

The Company are paying the Maximum Dividend, together with back Dividends on their Stock and Ordinary Share Capital.

Tenders are to be addressed to the Company at their Offices, Oak Lane, Sevenoaks, on or before Monday, the 21st day of May, 1906, and endorsed "Tender for Shares."

The Shares are payable as under—viz.:
£2 on application,
£3 on allotment,
and the Balance within three months of allotment.

Where no allotment is made, the deposit will be returned in full.

Forms of Tender on application at the Company's Offices.

By order of the Board,
ALFRED GRAINGER,
Secretary.

Water-Works Offices,
Oak Lane, Sevenoaks,
April 12, 1906.

Now Ready. Price 17s. 6d. net.

COMPOUND DIVISION,

COST SHEET,

READY RECKONER,

DESIGNED FOR QUICKLY CALCULATING ANY NUMBER OF ARTICLES IN PENCE AND THREE PLACES OF DECIMALS OF A PENNY,

From 1 to 10,000, thence by Tens to 100,000.

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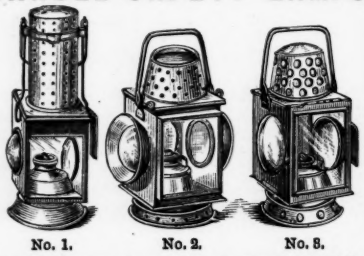
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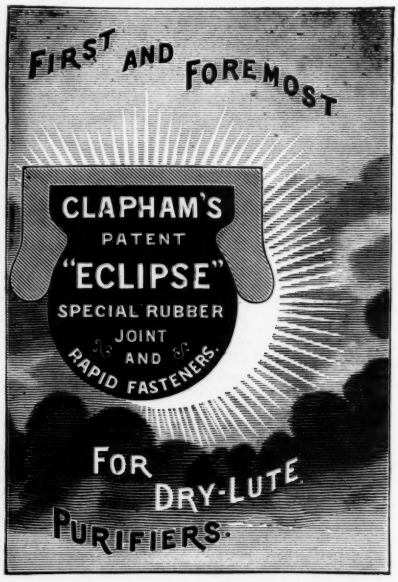

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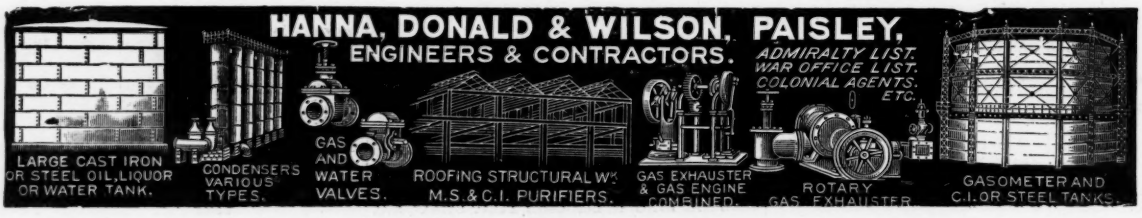
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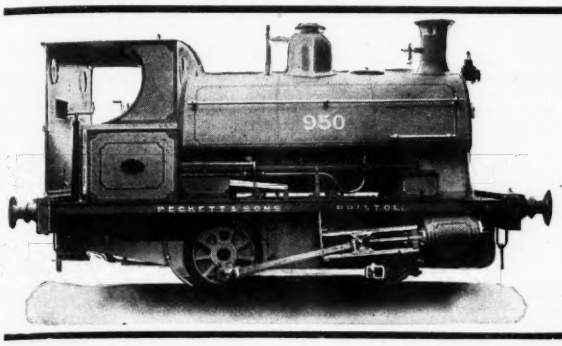

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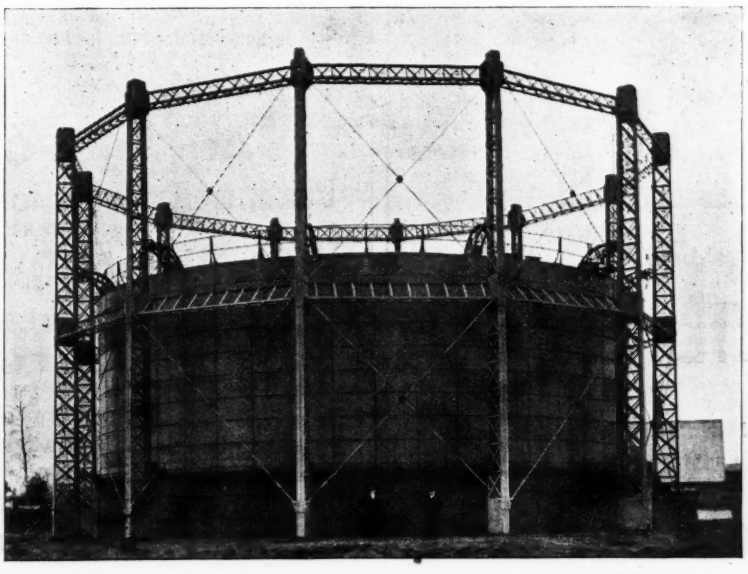

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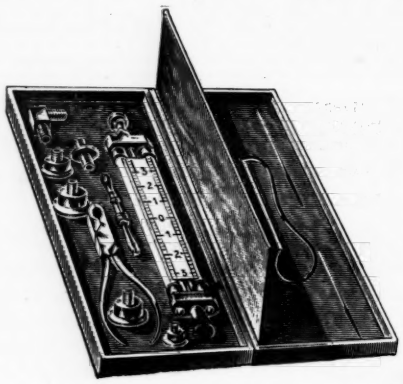

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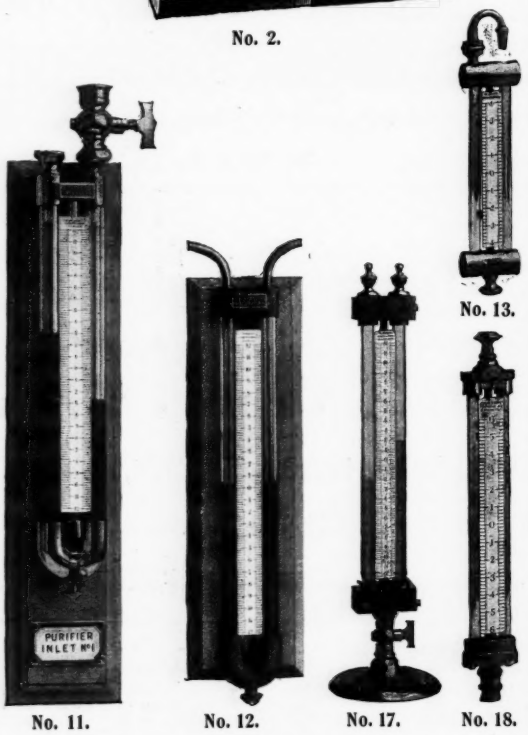

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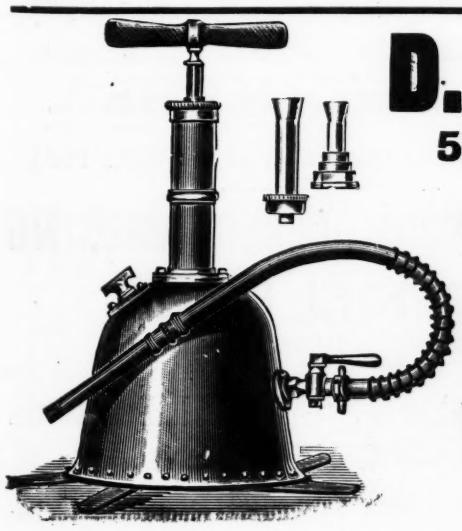

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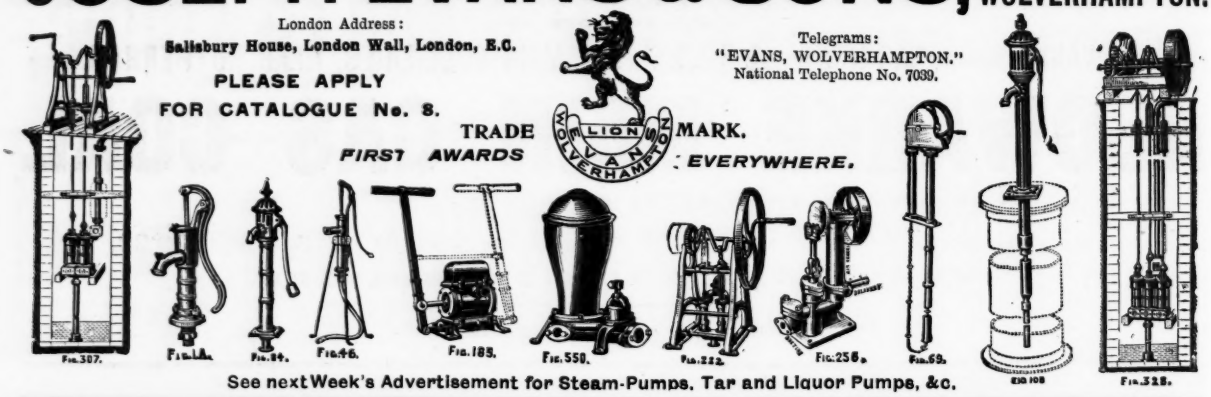

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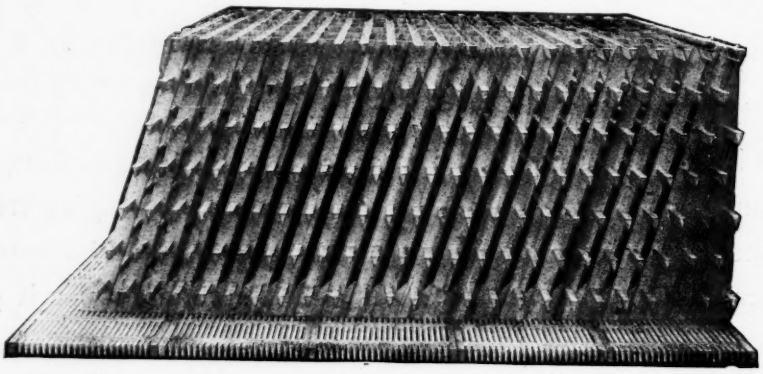

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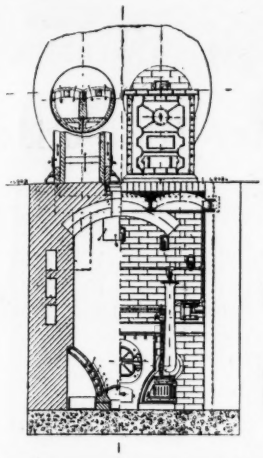

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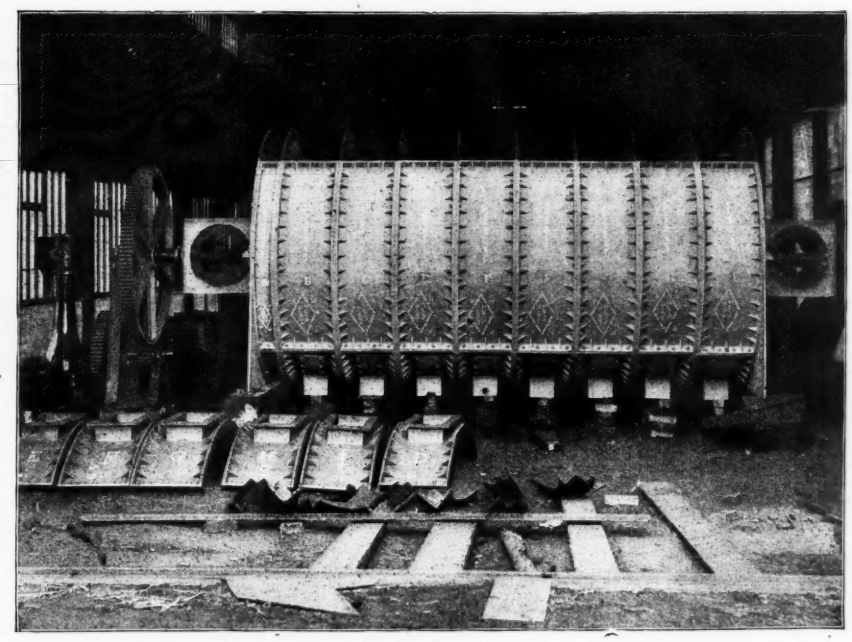

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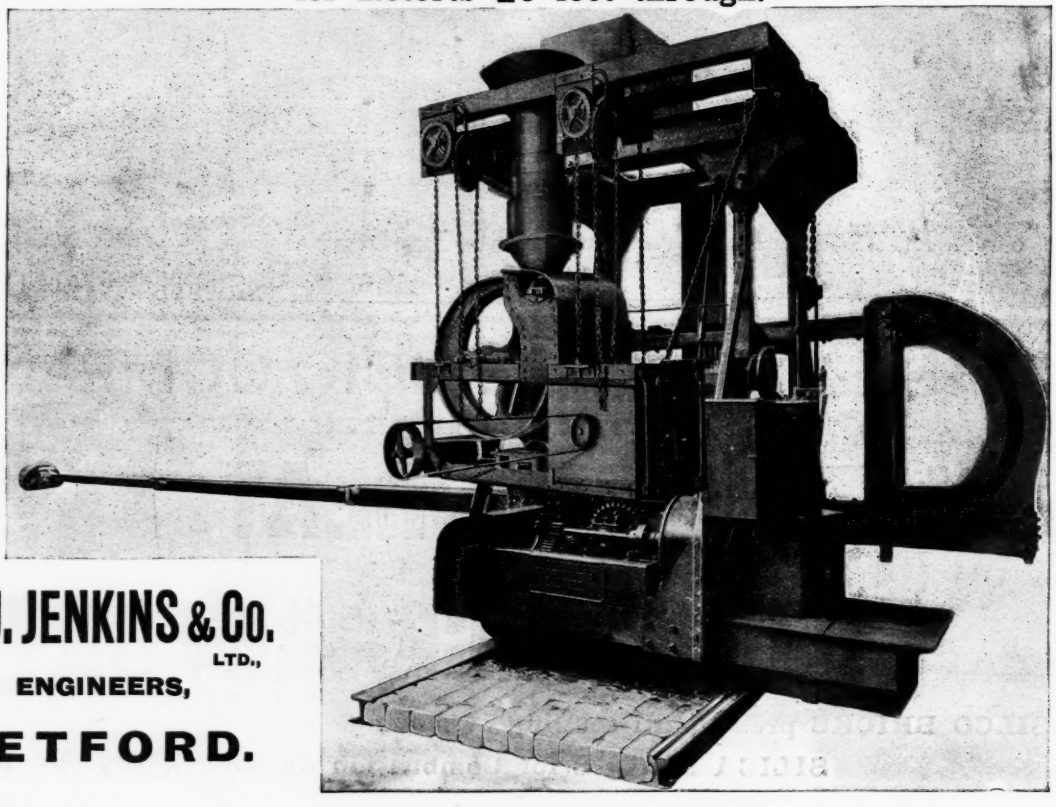

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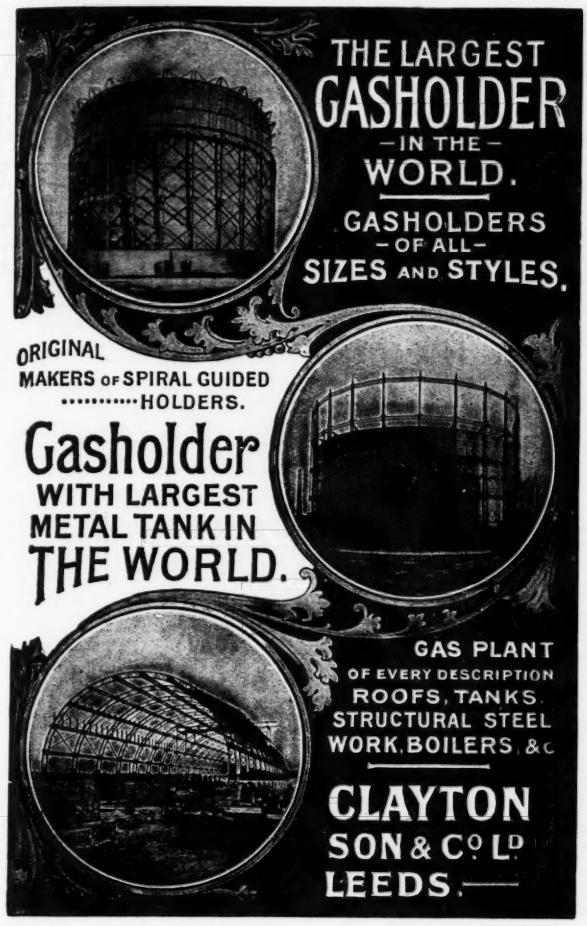

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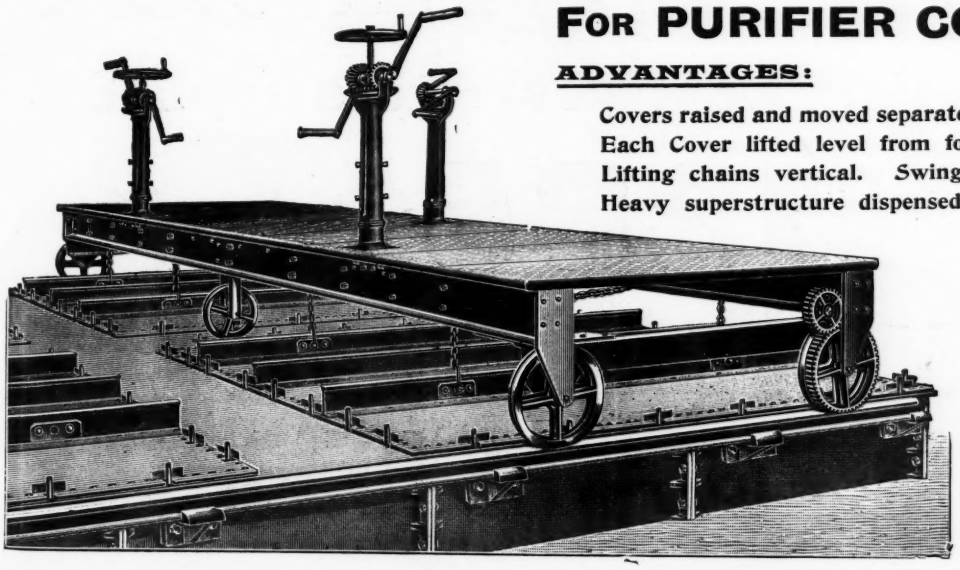

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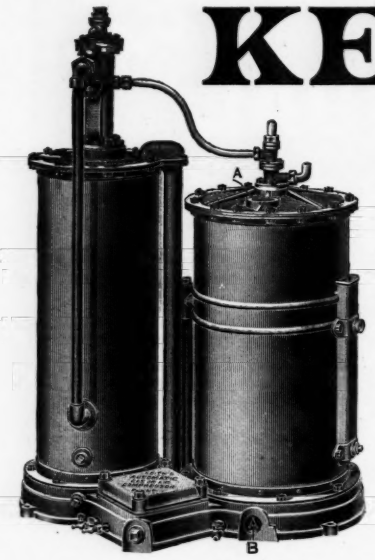

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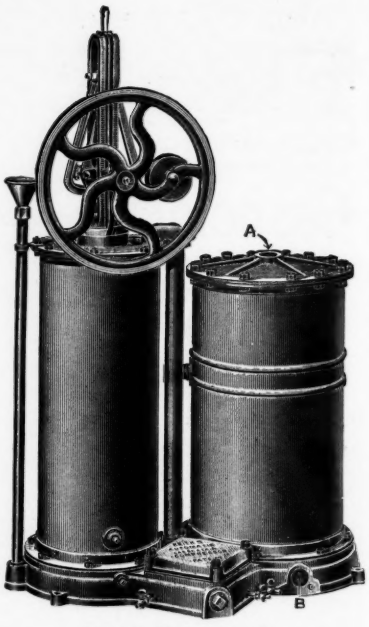

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